HERPETOLOGICA

Established 1936. Organ of the HERPETOLOGISTS LEAGUE,
A.A.A.S. Associate. Society of Systematic Zoology, Affiliate.
President, Dr. Hobart M. Smith. Vice-President, Dr. Angus M. Woodbury.
Secretary-Treasurer and Publisher, Chapman Grant,
Route 1, Box 80, Escondido, California
Edited by the Officers. Policies determined by the Members. $3.00 per volume

Vol. 9 July 22, 1953 Part 2

AGRICULTURE AND APPLIED SCIENCE LIBRARY MAY 10 1954 MANHATTAN KANSAS STATE

Notes on a Population of Leaf-nosed Snakes *Phyllorhynchus decurtatus perkinsi*

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INTRODUCTION

In 1948 to 1951, while collecting reptiles in the Borrego area of eastern San Diego County, the writer was impressed by the difference in the size and number of leaf-nosed snakes caught in successive years. In 1948, for instance, all sizes of *P. d. perkinsi* were collected, whereas in 1949, although all sizes were caught, there was a marked increase in the number of large specimens. Conversely in 1950, there were large numbers of small leaf-nosed snakes taken with only a few large individuals. In 1951, only a few leaf-nosed snakes were seen and collections were composed only of large individuals (see Fig. 4).

In order to determine the extent of fluctuations in population characteristics of this species, the literature, records, and notes on the *Phyllorhynchus d. perkinsi* from the Borrego area from 1931 to 1951 were compiled and are presented herein. Because there is little information on populations of reptiles over a long period of time, as there is for other animals (Allee, *et. al.,* 1949), it is hoped that this material will be of some value.

It has been shown elsewhere (Brattstrom and Schwenkmeyer, 1951; Klauber, 1931, 1939) that the number of animals collected depends in a large part upon the activity of the collectors. For instance, there are few data available for the war years 1942-47, but this can be correlated with a shortage of gasoline rather than an absence of the reptiles. Because of the fairly large samples employed in this study, it is hoped that the human factor has been reduced to negligible proportions.

AREA

In the collections utilized in this study, the majority of *P. d. perkinsi* come from the Borrego area of northeastern San Diego County, California. For this reason and because this comprises a relatively homogeneous population (Klauber, 1945), the discussion presented here will be restricted to this population, the taxonomy of which has been fully discussed (Klauber, 1931, 1935, 1940, 1943, 1945).

As far as the night collector is concerned, the "Borrego Area" consists of Highway 78 from Scissors Crossing (approximately 12 miles East of Julian) via Sentenac Canyon, Yaqui Well, The Narrows, and Ocotillo to the San Diego-Imperial County border and the paved roads to and about Borrego Valley north of Highway 78. The area consists of a large dry wash parallel to Highway 78 and a few side basins converging with the large basin which is Borrego Valley. Almost the entire area is Lower

Sonoran desert barely ranging into desert Upper Sonoran at its western border. Gene flow between members of this population is probably not disturbed by any ecological or topographic features. This area is characterized by low rainfall, granite boulder hills, decomposed granite bajadas, washes and open areas. The predominant vegetation is Creosote *(Larra divercata)*, Ocotillo (*Fouquiera splendens*), Mule Weed (*Franseria dumosa),* with some Agave *(Agave deserti)*. For a more detailed description see Klauber, 1931, 1939.

The mean annual temperature at Borrego is 70° F. The range varies from 121° to 15° F. It should be apparent however, that weather data from weather bureau stations do not reflect the weather and temperature present in the micro-niche in which the snake lives. To give some idea of variation in climate, the yearly rainfall for the various years are presented in Figure 1. (Data for 1931 to 1944 from Brawley, 1945 to 1951 from Borrego. Brawley is approximately 30 miles southeast of Borrego in Imperial County).

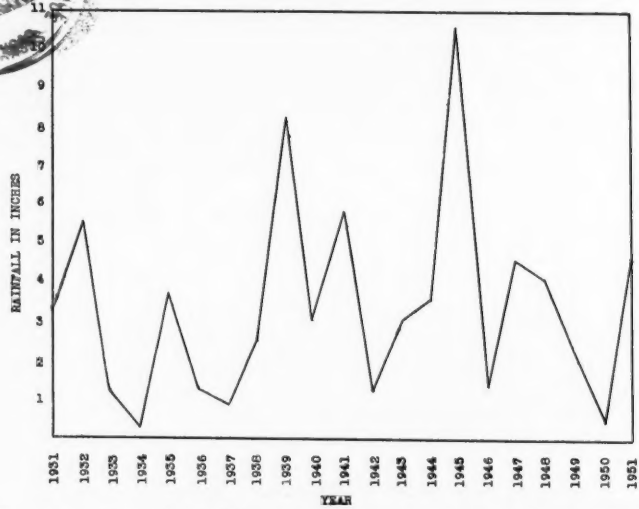

FIGURE 1. Annual rainfall in the Borrego Area. Data from 1931 to 1944 from Brawley. Data from 1945 to 1951 from Borrego Valley.

MATERIALS AND METHODS

Most of the collecting in the Borrego area has been done by California herpetologists and especially those in the San Diego area. As a result, the records of the San Diego Society of Natural History, California Academy of Sciences, San Diego State College, University of California at Los Angeles, and the personal collection of L. M. Klauber were examined for the data presented herein. The writer wishes to thank Dr. Laurence M. Klauber, Merrel A. Taylor, Joseph R. Slevin, and Dr. Raymond B. Cowles for loan of data from these institutions.

Previous reports on the Borrego population of *P. d. perkinsi* are concerned for the most part with seasonal incidence, habitat distribution,

and relative abundance. It has been shown by Klauber (1943) that *P. d. perkinsi* shows sexual dimorphism in tail length. Because of this, only snout-vent (*i.e.* body length) measurements are used in this study. Differences in chart data, discussed below, result from the fact that in some cases, certain data were omitted from the specimens or reports (body length, sex, locality, month of collection, etc.).

DESCRIPTION OF THE POPULATION

Figure 2 shows the collecting location of 497 specimens of *P. d. perkinsi*. For the forms listed as "Borrego Area" no specific locality data

Year	Scissors Crossing	Sentenac Canyon	Yaqui Well	Narrows	Dry Lake	Yaqui Pass	Borrego Valley	Borrego Area	Total
1931				1			8		9
1932							1		1
1933				7	1		1		9
1934				3	9		1		13
1935			7	7	40				54
1936			11	4	11				26
1937			8	2	14				24
1938			4	8	4				16
1939	1	1	6	16	11		3	21	59
1940		3	6	3	5			83	100
1941	1	7		3	2		2	14	29
1942							1	3	6
1943				1			1	1	3
1944									0
1945			1	4	4	1			10
1946					1	1			2
1947								6	6
1948			9	4					13
1949		2	2	8	4	1	4		21
1950		1	2	9	23	2	12	42	91
1951							3		5
Total	2	14	56	8	132	5	37	170	497

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FIGURE 2. Distribution of *Phyllorhynchus* in the Borrego Area by locality.

are known. Other specimens are referred to the nearest locality. It is apparent that most specimens come from typical Lower Sonoran desert areas and only a few have been found in the Upper Sonoran of Scissors Crossing and Sentenac Canyon. Dry Lake is the type locality of *perkinsi*.

Figure 3 represents the numerical relations of sexes of leaf-nosed snakes for the various years by months. From these data it is apparent that the sexes occur in equal numbers in every month except June, at which time males outnumber females. This may be explained by the

Year	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
1931	1-0				2-2	2-2					9
1932								1-0			1
1933					1-0	4-1	2-1				9
1934			2-1	2-2		0-1		2-0	1-2		13
1935			6-0	8-9	12-11	1-3	1-0		1-2		54
1936			2-4	6-12	1-1						26
1937			1-0	3-3	11-4			1-1			24
1938				1-1	6-2	1-2	0-1		1-0	1-0	16
1939		0-1	4-2	3-1	26-21	0-1					59
1940			2-0	4-3	36-16	0-3		0-1			67
1941				6-3	5-0	10-2	0-2	0-1			29
1942					2-1	1-0	1-0	1-0			6
1943				2-0							2
1944											0
1945				0-1	5-3		1-0				10
1946			0-1		1-0						2
1947				3-0	3-0						6
1948				3-1	0-1	4-3	1-0				13
1949			5-1	2-0	3-1	5-1	1-1	0-1			21
1950			31-17	10-9	13-9	0-1	1-0				91
1951					2-2	1-0					5
Total	1-0	0-1	53-26	53-45	131-74	29-20	8-5	4-5	3-4	1-0	283-180
Grand Total	1	1	79	98	205	49	13	9	7	1	463

FIGURE 3. Total number of male and female (in that order) of *Phyllorhynchus* collected each month in the Borrego area from 1931 to 1951.

supposition that in June the males are actively wandering in search of females and hence will be exposed to capture in greater numbers or that the females have already been fertilized and have become more secretive or inactive.

It is also apparent from Figure 3 that the greatest number of individuals were caught in April, May, and June. Quite possibly this may be correlated with collecting activity in the area and not necessarily avail-

Lengths	Years 1931 to 1951																													
in mm.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	Total
91-110																				1		1
111-130																						0
131-150									1											5		6
151-170				4		3	2	1	2	1	2	3						2	1	40		61
171-190				2	1	5	1		4	3	1	1			2		1	1	3	30		55
191-210					1	7	1	2	4	4	2	1			2	1				11		36
211-230			2	1		5	2	1	6	11	1				3		1	1				34
231-250			1	2	2		1		3	11	2				1			1	1			25
251-270	1				2	1	1	2	2	6	1											16
271-290				1	2	2	2	2	5	4	3						2				1	24
291-310			1		4				3	9	3		1					4	3	2	1	31
311-330	1		1	1	4	2	3	1	12	15	5				1		1	1	1			49
331-350		1	1		9			3	4	8	6	1			1			2	4			40
351-370	3		1	1	8		4		4	8	3					1	1	1	6	1		42
371-390	2		1		10		1	2	4	8									2	1	2	33
391-410			1	1	7		3	1	3	5											1	22
411-430	1				3				1	5												10
431-450					1					1												2
Total	9	1	9	13	54	25	22	15	58	99	29	6	1	0	10	2	6	13	21	91	5	487

FIGURE 4. Sizes of *Phyllorhynchus* caught in the Borrego area in each year.

ability of the snakes. Virtual total absence of the snakes during the winter is probably directly ascribable to prevailing low temperatures. The size distribution of the *Phyllorhynchus* collected in each year is shown in Figure 4. These data verify the casually observed size differences noted

in 1948-51. The total lengths of all specimens show a distribution portraying the size variation within the total population. These data strongly suggest that the average life span of *P. d. perkinsi* is approximately 5 years. Juvenile individuals are usually under 210 mm. body length. By the second year *perkinsi* appears to grow to about 290 mm. By the third and fourth years the snake appears to grow to 350 mm. and 410 mm. respectively. Specimens over 410 mm. are probably 5 years old and occasionally perhaps 6 years old. Some individual variation may result from the differences in availability of food or from different growth rates among individuals. The age of reproductive maturity is not known. The smallest female from this area with eggs was 325 mm. long and probably in its 3rd year of growth.

Figure 4 also demonstrates the great mortality prevalent in young snakes. Most years that are characterized by large juvenile populations are followed by years wherein the second year class is notably smaller than expected. This seems to have been especially true for 1950-51.

Figure 5 shows the mean body length of snakes caught by months for all the years of the study. This shows that generally juveniles emerge earlier in the Spring. The young (smaller) examples are more common in April and May. Older and more mature individuals appear later in the year (June, July and August). This difference may be due to the fact that the young are coming out primarily in search of food whereas the adults probably come out primarily for reproductive purposes. The adults may have enough fat stored so that it is not essential for them to venture abroad for food until warmer weather comes. The change in mean body length might also be due to the large mortality rate of the juveniles.

Figure 6 represents the number of individuals caught each year as compared to the mean body length of all specimens caught in each year. The mean body length of all specimens for all the years is 283 mm.

In the data shown in Figure 6, there are indications of a possible cycle. In 1935, 1940, 1945, and 1950 more individuals were caught than in other years. This is apparently independent of the size of the individuals. It is not known if this is correlated with the probable 5 years of growth of individuals or if this is just an item of chance as most supposed cycles are assumed to be (Allee, *et. al.*, 1949, pp. 318-327). What effect predators have on the *Phyllorhynchus* population is not known. Predators on *perkinsi* are not known, but it is assumed that such animals as badgers, kit foxes, and owls prey on these snakes.

NATURAL HISTORY

In the Borrego area, large eggs are found in *Phyllorhynchus* in June (11 specimens) and July (3 specimens). Eggs have been found in one specimen each from April, May, and August. The egg number is usually 3 (6 specimens; measuring 325, 339, 359, 365, 384, 402; mean 362 mm.) or 4 (8 specimens; measuring 354, 356, 356, 360, 368, 370, 396, 442; mean 376 mm.).

Most of the specimens in the Borrego area in 1948-1951 were collected between 9:00 and 11:30 P.M. The following is the nightly distribution of *Phyllorhynchus* for those years:

6:00- 7:00 P.M.	3
7:00- 8:00 P.M.	11
8:00- 9:00 P.M.	11
9:00-10:00 P.M.	16

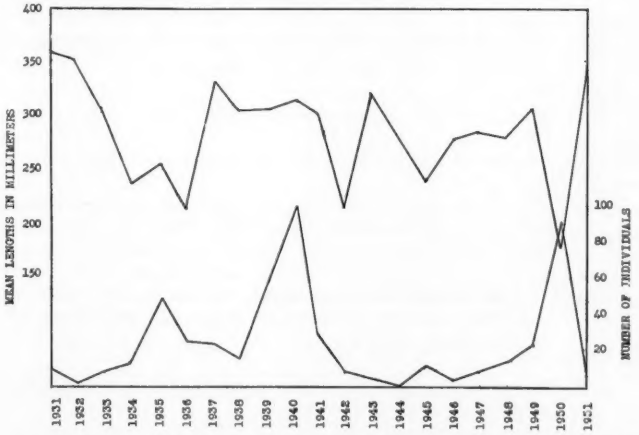
10:00-11:00 P.M.	18
11:00-12:00 P.M.	16
12:00- 1:00 A.M.	3
1:00- 2:00 A.M.	1
4:00- 5:00 A.M.	1

Phyllorhynchus does not appear to be adversely influenced by strong winds. *Phyllorhynchus* lives very close to the ground and wind velocities are greatly reduced close to the surface of the ground (Geiger, 1950) and thus would presumedly have little or no effect on the snake.

FIGURE 5. Mean body lengths in millimeters of *Phyllorhynchus* from the Borrego area by months. Data from all specimens available from 1931-1951.

Month	Number of specimens	Mean body length
February	1	311
March	1	157
April	79	207
May	97	251
June	200	291
July	46	323
August	13	311
September	8	286
October	7	287
November	1	252

FIGURE 6. Graph showing the relationship of mean body length (upper line) and number of individuals of *Phyllorhynchus* caught (lower line) in the Borrego area in each year. A line at 283 mm. would be the mean body length for all specimens for all the years.



According to Klauber (1935), the food of *Phyllorhynchus* consists of lizard eggs and *Coleonyx* tails. Eggs, probably *Coleonyx,* were found in most of the stomach contents examined by the writer. Lizard legs (probably a small *Callisaurus*) were found in one specimen and unidenti-

fied Hymenoptera were found in another. Sand was present in most of the specimens examined.

In 1948-51, 33 specimens were caught during dark nights whereas 39 were collected on nights of full moon. Two were collected when the moon was in the quarter phase and one was collected during a full eclipse of the moon (April 12, 1949). The moon apparently has no different effect on the activity of leaf-nosed snakes than it does on *Leptotyphlops humilis* (Brattstrom and Schwenkmeyer, 1951).

On being captured, most of the specimens secreted a musk-like substance from the anus. This "musk" does not have such a disagreeable odor as does that of *Leptotyphlops*.

Of the approximately 500 specimens of leaf-nosed snakes collected in the Borrego area, only one albino has been discovered. This appears to be the first record of an albino for the genus. This specimen was collected by the writer on June 10, 1952, in Borrego Valley. It was a small specimen, probably a young of the year. The color was white with faint markings of light brown on the back. The eye was dark, but appeared red at certain angles of lighting. This red is probably not due to "eye shine." The specimen is now in the personal collection of L. M. Klauber.

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Habits of the Desert Tortoise, *Gopherus Agassizii*

By UNA G. NICHOLS

We brought a male tortoise, *Gopherus agassizii,* from a wash near Johannesburg on the Mojave Desert in October, 1929. Although his shell was only 2¼ inches in width by 2⅞ in length, apparently he was four or five years of age, since his shell had already hardened.

We brought two females of a similar size from the same region in 1930.

When the male was placed before one of the newcomers, he nodded vigorously in welcome. Walking the length of one plate, he nodded again. In the enthusiasm of his greeting more than an hour passed before he had circled the small tortoise.

Female #3 was an adult when we first saw her in 1938. Another female was given to us in 1943 after she had been run over by a light truck while walking along a rut in a desert road.

Two plates of her carapace had been crushed and half of each one was missing. The ragged edge of one plate pressed into the flesh. Maggots squirmed inside the cavity. The pressure had torn the gular plates from the humerals, the width of the plastron.

Straightening the bent plate of the carapace enough to relieve the pressure, we cleansed the wound and dusted it with a sulfa powder. The hole in the carapace was covered with adhesive tape. The tape had to be renewed several times each summer for two years. By then a thin layer of shell had grown over the flesh sufficiently to form a protective covering. The space between this and the broken plates has not filled in during the succeeding years, but has left a small cavity sealed off from the flesh of the animal. New growth between the separated plates has strengthened the plastron. It differs from the old in that it resembles the horny skin of the reptile's forefeet.

Even without distinguishing scars, each tortoise differs from the others as much as do horses or dogs of the same breed. Females #1 and #2 are most alike, but either one is easily recognizable even when the other is not present for comparison. The feet of female #1 are noticeably smaller than those of female #2 and the width of her head is nearly a third less. These two reptiles are the largest, female #1 after hibernation in 1952, weighed eight pounds, eleven ounces, the other was not weighed. The difference is slight between female #3 and the male. He weighed seven pounds, seven ounces, at the time the female was weighed. Female #4 is little more than half the size of the others and her weight was only five pounds, eight ounces.

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A short time after sunrise and in the latter part of the afternoon, the tortoises graze on the clover and grass in their yard. They are particularly fond of any new growth. Figs, bananas, peaches and melons, rose petals, dandelions and many other flowers are favorites, as well as grasses and fig and grape leaves after they have thoroughly dried.

At one time they dug under a fence. Within a week they had eaten every radish in a large bed, even though the roots were sharp and bitter from age. However, beets, chard and cabbage as well as the leaves of nasturtiums were not touched.

The tortoises ate every snail within reach until the summer of 1949. I had moved to another part of town during the winter and their new yard had little vegetation and no snails.

In July of 1950, within a half-hour after female #2 had left her nest, I found it dug open. All that remained of a clutch of four eggs were fragments of shell. At sunrise next morning females #1 and #4 ate the last of the shell as soon as they left their burrow.

In September of the same year female #1 laid three eggs. She had gone less than a yard from her nest when female #2 walked over and began to dig it open. Either the first tortoise failed to see what the other was doing or was indifferent; without hesitation she continued on her way.

As soon as the eggs were exposed, female #2 broke one and began to eat the shell. Carrying her to the far side of the yard, I covered the remainder with earth. Although she tried to return, I moved her back each time until at length darkness forced her to give up and go to her burrow.

Early next morning when I entered her yard, the tortoise was eating the last egg.

Since then I have scattered the broken shells of hen's eggs in their yard and there has been no recurrence of these attacks on the nests.

During the first two or three weeks after hibernation, the tortoises spend much of their time in feeding. When this urge for food has been satisfied, they begin to dig their burrow. This shelter is used almost as much in the hot weather for their midday rest as for night quarters.

As usual female #1 chose the new site in 1950. Since the ground was dry and hard she made slow progress. At length the soil began to pile up behind the tortoise and attracted the attention of female #3. She hurried forward, her neck outstretched and her eyes bright with interest. Then relaxing with her plastron on the ground and feet half withdrawn, she watched the other slowly but steadily gouge a hole with her forefeet.

When the tortoise was half-buried in the earth, female #3 stepped forward and flipped the soil behind her with her forefeet, then turning to the newly formed pile she began again. In this way she cleared the ground near the worker for a distance of two or more feet.

Teamwork has developed through the years and in a short time the others began to help. Usually a tortoise dug steadily for two or more hours, after which another took her place unless it was nearing the midday rest period. As the tunnel lengthened usually a second tortoise removed the loose soil, and when they began to enlarge the tunnel into a burrow, often two worked side by side with a third in the rear.

The burrow when completed, was entered through a crescent-shaped tunnel fourteen inches long. It slanted downward so that the ceiling was nine inches below the surface. The burrow itself was roughly ovate and measured twenty-eight inches by thirty-three with a height of slightly less than seven inches. The ground which formed the roof was so hard that I walked over it many times during the summer without breaking through.

Some of their burrows have been Y-shaped and others in the form of a T. From the first, each one has been communal. The tortoises crowd to the far end and sleep as close together as possible. Usually if a burrow is high enough, the last one to enter climbs on the backs of the group and settles himself for the night. I had a good opportunity to observe their sleeping habits several years ago after I had a long low house with a

detachable roof built for them. It was not until two years later that they discarded this for one of their own digging. Since then, however, I have seen them asleep many times and they have been in the same close group. But even in the comparative safety of their sleeping quarters, each one's head opening is protected by either the wall or the shell of another tortoise. During the hot weather one or more of the reptiles may spend the night above ground occasionally. Before going to sleep, he always places his head opening against a rock or a wall.

When fall comes the tortoises try to convert their summer home into a winter den. They run the new excavation at an angle with the tunnel and as much as seven or eight feet beyond the original burrow.

Since the earth is too damp during the rainy season for the tortoises to hibernate underground, I cover the entrance with concrete blocks; anything less would be dug around or shoved aside.

Once the tortoises begin to hibernate, they resist any attempt at removal. If they have settled in a narrow passage, they brace their powerful forefeet against the walls. Even though the hours spent in digging has worn their claws to stubs, it is very hard to dislodge them.

During hibernation I examine each tortoise about once a month. Even though each one is lifted and may be turned on his back for an instant, the only signs of life are a slight withdrawal of his head and legs, and a brief opening of unseeing eyes.

In 1950 the tortoises went into hibernation by the first of November with the exception of female #3, she was active until the fourteenth of the month. Usually she is the last to settle down for the winter and the male or female #1 is the first to become active in the spring. The weather turned warm in March, 1951, and roused the animals within three days of each other.

Their burrow was still in good condition when spring arrived, so the tortoises cleared it of the winter's accumulation of debris, and made use of it for another season.

The habit of helping each other is not confined to digging their burrow in the spring or their den in the fall. A typical example of this teamwork occurred one morning a few years ago. Female #3 was eating clover blossoms when she noticed female #2 trying to force her way through a narrow space between the fence and a rock half buried in the earth. Going to the other's side and letting her plastron sink comfortably to the ground, she watched with apparent interest. As time passed and the struggle continued, she walked up to the tortoise from the rear, and withdrawing her head, used her shell as a battering ram. After more than a quarter-hour of this cooperation, they were able to dislodge the rock. Female #3 returned to her clover while female #2 hastened toward some windfalls beneath a peach, without even a backward glance of acknowledgment.

Occasionally the females greet one another when they meet by nodding. At other times two or more may gather in the shade for their midday sleep. Even though facing in different directions, occasionally they nod for some time, a nod which may be so slight as to be scarcely discernable. It appears to express contentment, just as a dog wags his tail in a slow steady manner for the same reason.

The female's nod of friendship cannot compare in vigor with that of the male when he is courting. Our male tortoise showed an interest in a female for the first time in 1944 soon after emerging from hibernation.

He courted female #4 but no eggs were laid that season.

During the following years the male courted females #1, #2 and #4, but ignored #3. Each spring he chose one as his mate for the season, usually a different female from that of the previous year. His courtship continued until a week or two before hibernation, and he was as attentive to that one in the fall as in the spring.

In 1952 the male's current favorite was female #1. One morning he walked up to her and began to nod vigorously. After some time, since she ignored him, he butted her again and again with his gular horn. Later he nipped her forelegs and the sides of her head until she withdrew them into her shell. Again he butted her, but this time with such force as to turn her on her back. Waiting quietly by her side, he watched her struggles, but as soon as she was able to right herself, he renewed his attentions. Since all other activities of these reptiles are slow, their courtship and mating is no exception. As time passed, the male's harsh breathing, low grunts, and the clicking of the claws of his forefeet on the female's carapace could be heard for twenty or thirty feet. The female was silent as usual.

Beside this and a hissing which always occurs when a tortoise withdraws his head quickly into his shell, I have heard only one other sound from the male, and that just once. Only the week before we had brought him from the desert and he still felt so strange in his new surroundings that he continued to retract his head and feet whenever we drew near. The weather had turned cold, so I put him in a box padded with turkish toweling, for the night. Not long afterward I was standing beside the box or I could not have heard the high thin scream from the little tortoise inside. Apparently, while trying to escape, the claws of all four feet had caught in the loose weave of the toweling. Intense fear of a trap may have forced the sound from him.

Female #4 was the first tortoise to lay eggs. She laid four in 1945 and more in 1946, 1949 and 1950. Female #1 laid eggs in 1947 for the first time, again in 1948, 1950 and 1952. Female #2 was the last to begin laying, she dropped her first eggs in 1949, several more in 1950 and 1951. After sufficient time had elapsed for hatching, examination showed many of the eggs to be rotten. Female #3 has never laid an egg to my knowledge, however, from her appearance there can be no doubt as to her sex.

July 28, 1950, female #1 laid nine eggs. For several days before this occurred, she ate nothing. Basking in the early morning sunshine outside the mouth of her burrow until the increasing heat from the sun forced her to move, she walked only far enough to reach the nearest shade. Each sunset she returned to the burrow.

Late one afternoon the tortoise began to dig her nest in the mound of loose earth near the burrow's mouth. She settled down to this serious business after some time spent in the choice of a site. Using her hind feet only, she worked for more than an hour. The new nest was approximately six inches in depth, nine inches in diameter at the top and seven at the bottom.

After a brief period of rest, she worked herself round until her plastron rested on the rim and her hind feet were planted firmly on a large pebble which projected from one side of the nest. In this position her hind legs were stretched to the utmost. Evidently it took much effort to expel her eggs; many times she retracted her head until it disappeared

from sight. An hour and twenty minutes after the first egg appeared, the clutch lay in the nest.

The tortoise began to work the loose earth from around some eggs and under others with first one hind foot then the other. Each time she slid her long claws under the eggs very slowly, to avoid injury. At length when the eggs were together and on one level, she flung a shallow layer of earth over her clutch. After urinating on it as usual, she worked this over until the dampness had spread evenly throughout. Filling in the nest until it was even with the surrounding ground, she smoothed the surface and made it look the same as before. Not until then did she go to her burrow for the night although it was growing dark.

The only time I have seen a tortoise neglect to follow this procedure was in March, 1951. For several days the weather had been unusually warm. One after another the tortoises left their winter quarters for the first time that season. When less than two feet from the entrance, female #2 halted. Without even raising her hindquarters she extruded an egg and a moment later a second one.

The tortoise walked toward a sunny spot without showing the slightest interest in her eggs. She laid no more until the following August.

These eggs and another clutch were the only ones not laid in the latter part of the afternoon, usually at sunset.

July 6th, 1952, tortoise #1 dug her nest with the usual deliberation and care. When it was finished to her satisfaction, she settled herself in the laying position on the edge of the nest. Several minutes later a narrow strip of white shell appeared. Slowly it widened until at length an egg dropped into the nest. At intervals of from seven to twelve minutes five more followed.

Because an acquaintance had asked for eggs, I caught two in my hand before they touched the soil. The eggs were quite moist. Coarse in texture, the shells were a chalk white and without sheen. The female was unconcerned, although she watched me remove the eggs. As usual she spent much time and effort in covering the nest.

On October 17th, 103 days later, one of the eggs hatched. The three remaining eggs were rotten.

The hatchling ate nothing for more than a week, but since then his appetite has been good. Lettuce, clover and dry grass are his favorite foods. He drinks a teaspoonful of water from the palm of my hand every ten days, and spends from ten to twenty minutes in the process.

At first his shell had a luster, and each tiny line and dot was distinct. After four months the shell began to lose a little of this quality; it is possible that a change to the usual dull brown shades of his kind has begun.

Apparently he likes to be held, at such times he often nods very slightly again and again. It is possible that he merely likes the warmth of my hand. However, since I take care of him, and the older tortoises have been hibernating during most of his short life, his nod may be a mild expression of the social instinct.

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SOME INSECT FOOD OF *SCELOPORUS G. GRACIOSUS* (B.-G.).—A trip was made to range lands of Tooele County, Utah, on June 5, 1952. H. F. Thornley conducted Dr. D. M. Hammond, Dr. G. E. Bohart, Dr. E. J. Gardner, Seth Parkinson and the writer over the Mormon cricket, *Anabrus simplex* Hald., outbreak areas on a swing from Vernon to Little Valley Ranger Station, then by a different route back to the Benmore Experimental pastures area, from which airplane baiting for control of the Mormon cricket was taking place.

Ten sagebrush swift lizards were taken, largely in *Artemisia, Chrysothamnus,* and on the margin of a small meadow. Eight of the ten lizards were mature specimens. None were collected where Mormon crickets were numerous. Insects recognized in the stomachs on microscopic examination in the laboratory consisted of: 1 Thysanura; 1 Collembola; 6 Orthoptera, including 4 Mormon cricket nymphs in 3 stomachs and one grasshopper nymph; 1 Isoptera or termite; 1 Ephemerida or mayfly; 2 Odonata, 1 a dragonfly, the other a damselfly; 1 Plecoptera or stonefly; 5 Hemiptera, which included two Lygaeidae bugs—*Lygaeus kalmi* Stal and 1 Miridae bug, *Lygus hesperus* Knight; 11 Homoptera of which 6 were leafhoppers, including 1 *Dikraneura carneola* (Stal), 1 6-spotted leafhopper—*Macrosteles divisus* (Uhler), 1 clover leafhopper—*Aceratagallia sanguinolenta* (Prov.), besides 1 *Stictocephala festina* (Say) treehopper and 2 aphids; 23 Coleoptera, 1 a convergent ladybird beetle, 4 ground beetles, 2 weevils and 2 larvae; 19 Lepidoptera, all larvae, including 3 army cutworms—*Chorizagrotis auxilaris* (Grote), 3 other cutworms, three specimens that appeared to be diamond back moth larvae—*Plutella maculipennis* (Curtis), and three small hornworm larvae of the white-lined sphinx—*Celerio lineata* (Fabr.); 4 Diptera, including 1 Asilidae and 2 Tipulidae; 76 Hymenoptera, including 51 ants, 2 being carpenter ants, many western harvester ants—*Pogonomyrmex occidentalis* (Cresson) which are serious pests that cause great numbers of denuded areas on the range, 1 mud-dauber wasp, 2 chalcid wasps and 3 wild bees. In addition, 6 of the stomachs contained 9 spiders. Only a few grains of sand and one small plant leaf were found in the stomachs, other than the insects and spiders. The swifts were shot with .22 rifles, using birdshot.—G. F. KNOWLTON, Utah State Agricultural College, Logan, Utah.

ANTS IN HORNED TOAD.—A mature specimen of the desert short-horned lizard, *Phrynosoma douglassii ornatissimum* (Girard), was collected on sagebrush range land south of Benmore, Utah, during the forenoon of June 5, 1952. An examination of its well-filled stomach revealed 130 ants, *Formica laeviceps* Creighton (Det. Dr. A. C. Cole) and a few specimens of the western harvester ant, *Pogonomyrmex occidentalis* (Cresson). In addition were 2 weevils and 1 wild bee. An examination of three masses of food, present as "enlargements" along the intestine, and a large food mass present in the rectum, revealed 123 head capsules of ants, plus numerous ant body and leg fragments. In addition was the long, slender abdomen and part of the head of a medium-sized weevil. Certainly the Utah horned toads, like our red-shafted flickers, have a strong preference for ants in the diet.—G. F. KNOWLTON and B. A. BALDWIN, Utah State Agricultural College, Logan, Utah.

ALLIGATOR ESCAPEES IN SOUTHEASTERN VIRGINIA.—Many juvenile alligators, *Alligator mississippiensis* (Daudin), have been sold as curios and pets, scattering them to foster homes in all parts of the country. No doubt most of these soon die from improper care. In some cases, however, the young alligators are turned loose by persons who have grown tired of them, in the belief that they can take care of themselves no matter where they happen to be. That they can exist and grow normally in a strange environment is true to a certain extent if the ecological conditions approximate those of their native habitat. This may be proven by the occasional capture of individuals which have lived for several years in a free state in southeastern Virginia. The limit of the alligator's range is the coastal swamps of southeastern North Carolina.

Norfolk and Princess Anne counties lie adjacent in the extreme southeastern corner of Virginia. Princess Anne is bordered on the east by the Atlantic Ocean, and the southern edges of both counties form part of the Virginia-North Carolina boundary. This is an area of mild winters, January being the coldest month with a mean temperature of 42° F. An average winter has forty days in which the minimum temperature is 32° F. or below, and there are only five mean number of days in which the maximum temperature does not exceed freezing. The average date of the last killing frost in the spring is March 23, while the average date of the first killing in autumn is November 18—a mean frost-free period of 239 days. The average rainfall amount is 45.20 inches.

The southern portion of this area is taken up by the great Dismal Swamp, which extends into North Carolina. A large amount of surface water is present in the form of lakes, streams, canals, and rivers. These waterways are lined with picturesque bald cypress, backed by a thick growth of pine. The banks are overhung by an impenetrable tangle of undergrowth and American bamboo. *Agkistrodon p. piscivorus, Crotalus horridus atricaudatus, Natrix taxispilota, Hyla femoralis,* and *Microhyla carolinensis,* associates of the alligator in its native haunts, occur in this area, some reaching the northern limit of their range along the coastal plain here.

The insignia of the Naval Amphibious Training Base at Little Creek, Princess Anne county, is an alligator with widespread jaws. It is small wonder, therefore, that many baby alligators have found their way there as mascots of the sailors stationed at the base. Escaped and freed pets from there are probably the prime reason for the increasing number of reports of alligators seen in this area.

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On the morning of August 16, 1949, Mr. Fred L. Lunsford, residing at Lake Bradford, about one-quarter mile from the Amphibious Base, saw a small alligator in the water near the edge of the lake. He baited a hook with a live minnow and dropped it near the alligator. The minnow was taken immediately and the alligator was captured. It was reported to have been three feet in length and weighed fifteen pounds. Mr. Lunsford also stated that a week prior to this he had shot an alligator about four feet long that escaped, nevertheless, and that he had seen alligators in the lake for several weeks.

Miss Duke Daly, of Norfolk, received an eighteen inch alligator in 1944. She placed it in a backyard sandpile, where it stayed for a week and then escaped. It was seen from time to time in a small swamp near the home, but no attempt was made to recapture it until March 16, 1948, when two small boys stepped on it in the swamp and discovered its

hibernating site—a hole dug in the soft ground. It was to this burrow that the alligator retreated. Numerous attempts by spectators and police to remove the alligator from its hole by smoke and prodding resulted in failure. It was captured a week later several blocks away when two men saw it enter a storm pipe beneath the street. One of the men secured it by enmeshing its head in a crab net. After capture, the alligator was measured and found to be four feet in length.

Ditmars (Reptiles of the World, 1933) estimated that under optimum conditions in captivity the average rate of growth is near eleven inches per year, and McIlhenny (The Alligator's Life History) found growth very little different over the first five years. This alligator had lived under subnormal conditions for a little less than four years and had gained thirty inches in length, a good rate of growth under the circumstances.

To date no adults have been seen and no nests have been discovered. It is extremely doubtful that the species will become established in this area.—ROBERT F. CLARKE, 714 Union St., Emporia, Kansas.

A HIBERNATING *CHIONACTIS OCCIPITALIS ANNULATUS*. —Little information relative to hibernating sites of desert reptiles is available in the literature. Cowles (1941, Ecology, 22 (2): 125-140) has recorded his observations on a large series of desert reptiles unearthed as a result of land clearing operations by a tractor-scraper combination in the Coachella Valley of California. Comparatively few of the specimens discovered by Cowles were found *in situ*, being instead turned out upon the surface by the scraper blade. Of interest therefore, was the finding of an adult male *Chionactis occipitalis annulatus* in its hibernating site. This specimen, measuring 354 mm in total length, was uncovered about 1:30 p.m. on January 22, 1953 while I was vertically sectioning by hand a small dune of fine wind-blown sand about 3 feet high. The top of the dune was well covered with a growth of *Atriplex polycarpa* which, however, was sufficiently open to allow a liberal amount of sunlight to filter through upon the dune surface. The surface temperature of the dune directly over the hibernating site was 34.0° C. and the air temperature about five feet above the surface was 21.2° C. (thermometer shaded with hand). The snake was found coiled upon itself in a nearly straight burrow about one-half inch in diameter and about 10 inches long. Both ends of this chamber were plugged with sand. The burrow was situated on the south-facing slope of the dune, near its top, and about 3 inches below the surface. At this point the sand was moderately damp from the winter rains, but not so wet as it was from two or three feet deeper in the dune. When first picked up the snake felt quite cold to the touch and its escape movements were very slow and uncoordinated. Its cloacal temperature was 18.8° C. In only a few minutes, however, it had warmed sufficiently to react in a normal fashion.—CHARLES E. SHAW, Zoological Society of San Diego, San Diego 12, California.

LATE BREEDING OF *HYLA REGILLA* BAIRD & GIRARD.—It is well known that *Hyla regilla* has a relatively long breeding season. Data presently available indicate a season extending from January until mid-May, based primarily on observations made at the lower elevations of the species' range. What circumstances prevail in the higher reaches, especially after severe winters such as was the case in 1951-52, are not so well known.

In July of 1952 the opportunity was presented to observe these frogs at the higher elevations of the Sierra-Nevada of central California. The first indication that breeding was still in progress was on July 14, when a fairly large chorus started about 9:45 p.m. at the south end of Silver Lake, Amador County. This is at an elevation of about 7200 feet. On the following evening, just after dark, an even larger chorus was heard at the same place. It was then decided to follow state highway 88 up over the Carson Pass to survey areas at higher elevations. Between Silver Lake and Carson Spur several small choruses were heard. At Carson Spur (elev. 8100 feet) there was a fair sized chorus in a pond that still had a large snow bank around the sheltered side. Just to the south of Carson Pass, Alpine County, at an elevation of 8600 feet there was another good chorus. This pond also had a large snow pack protruding into one side of it.

On the night of July 16 the chorus at Carson Pass was again active, and 0.5 mile west of the pass a new small chorus was heard. This night the frogs at Carson Spur were more active than on the previous night, with no breaks in the chorus at all during the period of observation. The notes were high pitched and came in rapid succession. On return to camp at 11:00 p.m. the Silver Lake frogs were calling very actively. Search of these various localities both at night and during the day failed to reveal any eggs or larvae; so it appeared as though the breeding period in this area had just begun. This was further indicated on July 18 by the capture of a female *Thamnophis e. elegans* at a small lake on top (elev. 7900 feet) of the southern rim of the valley containing Silver Lake. This snake contained the remains of two *Hyla regilla,* one of which was a female with a full complement of mature eggs ready for deposition. Quite a number of the eggs had been extruded and pressed around the frog during the process of being swallowed.

From these observations it would seem that breeding may take place rather late in the season at high elevations in a fashion parallel to that which probably exists in interior British Columbia (Carl, 1943—Brit. Columbia Prov. Mus. Handbook No. 2:1-62).—R. L. LIVEZEY, Biology Dept., Univ. Notre Dame, Notre Dame, Ind.

OCCURRENCE OF *RANA PIPIENS PIPIENS* Schreber in Alpine Co., Calif.—Records of *Rana p. pipiens* from California are few. The form has possibly been introduced into all known localities in the northern half of the state; this is known to be the case at Lake Tahoe and nearby Fallen Leaf Lake (Stebbins, Amphibians of Western North America, 1951:355). On August 12, 1952, two young adults of this frog (a male and female) were taken about 5 miles east and south of Woodfords, Alpine County, California. The locality was a roadside pond resulting from an irrigation ditch overflow near the eastern end of Diamond Valley at an elevation of about 5400 feet. This valley is a partially isolated southern extension of the Carson Valley of Nevada. Although this

site is only about 17 airline miles southeast of Lake Tahoe the two localities are separated by the Carson Range, making it improbable that the frogs were derived from that area. The greater likelihood would be their influx from the Carson Valley or introduction by the farmers of Diamond Valley. None of the diagnostic characters usually employed would serve to separate these California specimens from those of the midwest when they were compared.—R. L. LIVEZEY, Biology Dept., Univ. of Notre Dame, Notre Dame, Ind.

FURTHER EVIDENCE OF THE OCCURRENCE OF THE WOOD TURTLE, *CLEMMYS INSCULPTA* (LE CONTE), IN NORTHEASTERN OHIO.—During the summer of 1952, a large live *Clemmys insculpta* in the Rocky River Trailside Museum, in Rockport Township, Cuyahoga Co., Ohio, was brought to my attention. It had presumably been captured in late June. It was typical, but possessed on the posterior lobe of the plastron a prominent scar from an earlier fracture. The specimen was kept alive at the Trailside Museum until the end of the summer. During the third week of July it laid a number of eggs, ultimately destroyed by insects. Through the generosity of Mr. Harold E. Wallin, the park naturalist of the Cleveland Metropolitan Park System, the turtle was presented to me, and is now No. 500 of the Cleveland Museum of Natural History.

Still another specimen of wood turtle, a medium-sized male, was found at the same locality during the summer of 1951. This was liberated without mark at the end of the season.

Conant (Reptiles of Ohio, 1951, pp. 8, 13, 205) has discussed the probable occurrence of *C. insculpta* in Ohio, but has rejected all previous records as based upon introduced specimens. The present record may or may not also be so interpreted. The status of this species in Ohio thus still remains in doubt, and can be settled only by further investigation in the northeastern part of the state, where it is likely that *C. muhlenbergi* (Schoepff) also may occur.—FRED G. THOMPSON, Dept. of Zoology, Cleveland Museum of Natural History.

ANOLIS SAGREI IN THE MIAMI AREA.—On October 27, 1952, while walking westward from Le Jeune Road in the city of Coral Gables, the author captured one adult and three juvenile *Anolis sagrei.* Several more specimens were seen but not captured.

The identification of these specimens was verified as *A. s. sagrei* by Dr. Hobart M. Smith, University of Illinois Museum of Natural History. The adult is in the author's private collection and the three juveniles are UIMNH Nos. 32558-60. Dr. Smith has informed us that six other specimens of *Anolis s. sagrei* (Nos. 28627-32) were earlier found by Mr. H. W. Peterson, in the vicinity of S.W. 19th St. and 19th Ave. in the city of Miami. Only one of these has any scales of the supraorbital series in contact medially.

The only previous records for this subspecies in the United States are those listed by Oliver (Copeia, 1950, No. 1, pp. 55-56) for Tampa and St. Petersburg.—EDWARD T. WILLIS, JR., University of Miami, 335 University Drive, Coral Gables, Florida.

SOME HERPETOLOGICAL NOTES FROM SOUTHERN NEVADA.—*Leptotyphlops humilis humilis* (Baird and Girard)—Western Worm Snake.

During the early summer of 1951, the Museum of Biology of the University of Nevada undertook a two-week field trip to the vicinity of Ash Meadows, a large thermal spring area located in the southern extremity of Nye County, Nevada. This area is actually an arm of the Amargosa Desert. It was during this excursion that an adult worm snake was collected. The snake was picked up by Dr. Ira La Rivers, Mr. Ted Frantz, and the author after it had first been observed crawling across a dirt road shortly after twilight on June 24. This worm snake (UNMB 2869) was a pregnant female and contained 6 ovally elongate eggs and 1 oval egg in the oviducts. The elongate eggs averaged 14.5 mm. in length and 4.5 mm. in width, and the oval egg was 8 mm. in length and 5 mm. in width. The total overall length of the snake was 225 mm.; the tail length, 17 mm. The surrounding vegetation in which the animal was found consisted of dominants of the four-winged salt bush, *Atriplex canescens* James, and the screw-bean mesquite, *Prosopis pubescens* Benth. The soil was extremely alkaline and in some portions was surfaced with a thick alkali crust. The collection of this specimen represents a somewhat northern record for *humilis* in Nevada and adds Nye County to its known range.

A worm snake was extracted from the stomach of an adult rainbow trout, *Salmo gairdneri* Richardson, by Mr. Al Jonez, fisheries biologist for the Nevada Fish and Game Commission, on April 5, 1951. The trout had been caught by a fisherman in the newly formed reservoir, Lake Mohave, which now provides a lacustrine boundary separating Clark County, Nevada, from Mohave County, Arizona. With the completion of the construction of Davis Dam the waters of the Colorado River began to back up and extend their width, flooding and then submerging completely the lower environments immediately adjacent to the former flood plain of the Colorado River. Those animals which could not readily escape this great change in their surroundings succumbed in one way or another either directly or indirectly to the rapidly rising waters. The worm snakes, apparently not being able to evacuate the area fast enough, and also perhaps because of their resemblance to annelids, became a tasty morsel for the rainbow trout. The snake, a small, shriveled-up individual, is number 3036 in the herpetological collections of the Museum of Biology. Mr. Jonez recorded one other instance in which a trout had swallowed a worm snake during the formative stages of Lake Mohave; unfortunately, however, this specimen was not saved.

Masticophis taeniatus taeniatus (Hallowell)—Great Basin Striped Racer.

Three adult striped racers were secured in Clark County, Nevada, during the summer of 1950. A medium-sized adult was collected by Mr. Oscar V. Deming, U.S. Fish and Wildlife Service biologist for the Desert Game Range, on August 18, at Cabin Spring, Sheep Mountains. This racer (UNMB 2247) was collected at an elevation of approximately 6500 feet in the pinyon-juniper (*Pinus cembroides* var. *monophylla* (T. and F.) Voss—*Juniperus utahensis* (Engelm.) Lemm.) vegetation association. The other two specimens were also adults and were collected by the author on July 26 (UNMB 2245) and July 27 (UNMB 2246) near the Willow Creek Y. M. C. A. Summer Camp in the Spring (Charleston) Mountains. Both of these swift moving animals were collected during

the early afternoon and were killed or seriously wounded with .22 cal. dust shot. The area in which they were found was situated in the pinyon-juniper association also at an altitude approximating 6500 feet. Although Ortenburger (1928, Mem. Univ. Mich. Mus., 1:75) included Clark County in the general range of this species, these records are the first to my knowledge of the actual presence of *taeniatus* there. Johnson, Bryant, and Miller (1948, Univ. Calif. Publ. Zool., 48 (5): 271) collected 4 specimens of *Masticophis taenitatus* "only in the piñon belt of Clark Mountain," San Bernardino County, California, an area approximately 50 miles to the south of the localities mentioned above, but in the same general biologic environment. The striped racer will probably, I believe, be found to inhabit the other higher mountain ranges in southern Nevada that possess a pinyon-juniper vegetation association.

Chionactis occipitalis talpina Klauber—Northern Shovel-nosed Snake..

The Museum of Biology herpetological collections contain an adult specimen of the northern shovel-nosed snake which the author picked up DOR on U. S. Highway 95, 39.5 miles southeast of Goldfield, near the Sarcobatus Nevada State Highway Maintenance Station, Nye County, on July 19, 1947. The specimen was somewhat smashed by automobile traffic before it was found, and consequently, is not in the best condition. The total overall length measured after the animal was preserved is 295 mm.; the tail length 63 mm. This *talpina* bears the serial number 2080 in the Museum of Biology collections. The general environment in which the serpent was collected is an ecotonal area between the creosote-bur sage vegetation formation or southern warm desert, and the shadscale vegetation association or northern cold desert.—BENJAMIN H. BANTA, Biology Department, University of Nevada, Reno.

A MULTIPLE APPENDAGE ANOMALY IN THE TADPOLE OF *RANA CATESBEIANA*.—On April 18, 1951, three large tadpoles of *Rana catesbeiana* were collected in a pond on the campus of Georgia Teachers' College, Statesboro, Georgia. These tadpoles were approximately the same size and presumably were the same age. No legs were apparent on any of them at the time of collection. These tadpoles were kept alive in an aquarium under identical conditions.

The hind legs of the tadpoles started to appear about May 1. The tadpoles appeared perfectly normal until May 8 when a small growth was noticed on the anterior dorsal surface of the upper part of the right leg of one tadpole. This small growth developed into a rudimentary leg giving the tadpole three hind legs, two normal and one rudimentary. Soon after the rudimentary leg appeared, there developed in this abnormal individual what seemed to be a severe case of edema. The skin of both normal hind legs became very swollen due to the collection of a transparent, colorless liquid beneath it. These swellings took on spherical forms which were approximately fifteen millimeters in diameter.

The rudimentary leg was attached primarily to the skin although a dark thread of tissue, presumably a blood vessel, entered the right leg between the rectus anticus femoris and the vastus externus muscles. This abnormal tadpole died May 30. At this time the rudimentary leg was

nearly one third the length of the normal hind legs, much darker in color, and had only two digits which had a full web between them.

At the time of the death of the abnormal one, the other two tadpoles seemed perfectly normal. Other abnormalities in the tadpole in question were as follows—the confirmation of the dorsal anterior region was much rougher than that of the other two. The sensory line system of the head was poorly developed. The gular region was somewhat swollen, and the tongue was exceedingly rudimentary. Also the entire body of the tadpole was slightly smaller than that of the other two. The two forward limbs had not appeared in the abnormal tadpole while they had become well developed in the others.

These tadpoles were preserved and are at present in the possession of the senior author. — WARREN J. HOUCK, Humboldt State College; CHARLES HENDERSON, Georgia Teachers' College.

AGGREGATION BEHAVIOR OF TADPOLES OF *RANA P. PRETIOSA*.—The observations here recorded were made on July 22, 1951, 1 mile west of Togwotee Pass, Absaroka Range, Teton County, Wyoming, at an elevation of approximately 9,200 feet, between 3:30 and 4:30 p.m., at an air temperature of 18° C. The site was a shallow mountain pond about 1 acre in size, with two thirds of its shore open, one third bordered by willows. Moose were active in and near the pond as indicated by hoof prints.

While walking the shore of the pond, a very dark area was noticed near the south shore. On closer examination, it proved to be a very dense aggregation of tadpoles having a surface area of 1 square foot, eight inches from the pond margin. The pond depth here was 5 inches. Later determinations showed these larvae of various sizes were of the western spotted frog (*Rana pretiosa pretiosa*). When my shadow fell upon the group, it seemed to disturb them, but it had no effect on spreading the aggregation. The water in and about the activity was very turbid. A continuous, but irregular, ticking sound, audible to a distance of 15 feet, proved to be a smacking sound made by the lips of the tadpoles as they continually swam to the surface, belly-up, gulped air, and then dove down again into the churning mass.

There were individuals joining and leaving the aggregation, but from the observations at the time, I estimated that more were entering the group. There were other tadpoles scattered very sparsely throughout the rest of this pond. An estimate at the time noted between 1000 and 1500 tadpoles in the aggregation and the immediate vicinity and this appeared to be about two thirds of the entire tadpole population of the pond.

The aggregation was disturbed when a thermometer was inserted into the mass to register the temperature at this point (24.8° C). This dis-

turbance scattered many tadpoles to an area of about four square feet, some moving away farther. The time of this action was at 4:17 p.m. By 4:25 p.m. the concentration had commenced to form again and by 4:35 it was about as thick as I had first seen it.

The water temperature 10 feet west along the shore, 8 inches out, was 23.6° C. and 15 feet east in the same position, 25.2° C. This gradient from west to east was probably due to spring action and of no significance to the aggregation. Before leaving, the bottom material at the point of aggregation was examined, but no noticeable difference was indicated, though it is very possible that this was a feeding aggregation.

There were a number of adult *Rana p. pretiosa* along the banks, and larvae of *Ambystoma tigrinum melanostictum* were sparsely distributed at the west end of the pond. As is generally true for most of these ponds in the mountains of this region, leeches were very abundant, and many of the tadpoles observed in the aggregation had small leeches clinging to their gular regions. When a series of these tadpoles was later preserved, many small leeches, not before noticed, released themselves.

A number of possibilities exist which might have motivated this aggregation. The first and, in many instances, most logical would be for feeding, but there was no indication of this. As I have indicated elsewhere, the abundant populations of leeches in this region heavily infest all aquatic amphibians, and aggregating may be a possible protective behavior against these parasites, forcing release or decreasing infestation.

Another solution may be related to the development of these forms. The warm season in this region is very short, which may greatly decrease the available period for transformation, and by collecting in close masses, these tadpoles may influence and contribute to their immediate surroundings in a manner that would effect a speed-up in metamorphosis.—CHARLES C. CARPENTER, Department of Zoology, University of Oklahoma, Norman, Oklahoma.

NORTHEASTWARD RANGE EXTENSION FOR *ARIZONA ELEGANS ELEGANS* KENNICOTT.—Recorded locality data for this subspecies place the eastern-most point of its range along the Texas Gulf Coast at Rockport (Ethridge, Herpetologica, 1948, vol. 4, pt. 6, p. 194). Additional records (Brown, Baylor Univ. Studies, 1950, p. 138) show the range to extend eastward in north Texas to Baylor County, and in south-central Texas to Comal County.

A DOR specimen from about 2 miles east of Bremond in Robertson County, found June 2, 1952, extends the known range eastward about 140 miles from Baylor County and approximately 75 miles in the same direction from Comal County.

Only part of the skin was salvaged so that most of the scale data are wanting. Scale rows at mid-body number 29.—BEN SWANSON, 3919 Gramercy, Houston, Texas.

Two British Anatomical Studies on American Reptiles (1650-1750)—I.—Hans Sloane: Comparative Anatomy of the American Crocodile

By R. H. AHRENFELDT

It may be of interest to students of the history of American herpetology to recall that, between the mid-seventeenth and mid-eighteenth centuries, two distinguished British physicians contributed studies on the comparative anatomy of American reptiles.

Sir Hans Sloane (1660-1753)—the learned naturalist and man of science to whom we owe the conception and foundation of the British Museum—spent fifteen months in Jamaica in 1688-89, and during this time recorded 16 species or varieties of amphibians and reptiles which he found there; and he also had occasion to make some observations (Sloane, 1725) concerning the anatomy of the American Crocodile (*Crocodilus acutus* Cuvier), which are the subject of the present paper.

Edward Tyson (1650-1708), an outstanding pioneer in the field of comparative anatomy (Cole, 1944), published, in 1683, a detailed and accurate account of the anatomy of a Timber Rattlesnake (*Crotalus horridus horridus* (Linné)) which had been sent from Virginia and presented to the Royal Society. It is proposed to consider Tyson's important work on the rattlesnake in a second article.

It may be noted, incidentally, that, whereas Sloane's name is included in the check-list of writers on American snakes (Wright, 1949), together with the names of his contemporaries and fellow-countrymen, Mark Catesby and John Ray, that of Tyson appears to have been overlooked. Tyson's work did not, however, escape the notice of Duméril & Bibron (1844).

Notes on the Anatomy of the American Crocodile (1689)

A few scattered observations on certain aspects of the anatomy of the Nile Crocodile (*Crocodilus niloticus* Laurenti) are to be found in the works of early writers, such as Aristotle and Pliny in ancient times, and Vesling (1664), Borch (1674), and von Hammen (1681), in the 17th century. A bibliography containing most of the early contributions to the literature of the biology, anatomy and physiology of the Loricata is given by the French herpetologists, Duméril & Bibron (1836), who showed a very thorough knowledge of the history of herpetology (although their references are, unfortunately, at times inadequate or inaccurate).

No comprehensive information on the comparative anatomy of the Loricata appears to have been published until 1688 (Cole, 1944). Sloane left England for Jamaica in 1687, and thus, when in 1689 he set about investigating the anatomy of the American Crocodile (*C. acutus*), he had to rely entirely on his own observations.

Goüye (1688, 1733) was the first to publish a relatively detailed description of the anatomy of a crocodile (*C. niloticus*), with interpolated notes by Duverney. However, the account of the anatomy of the same species, subsequently published by Duverney (1734), had in fact been written about 1681 (Cole, 1944), and a passage of the MS dealing with the structure of the heart was included in a paper by Méry, published in 1705.

Sloane's far less comprehensive, but not necessarily, in some respects, less accurate, observations on the anatomy of *C. acutus* were published

in 1725, and as they are thus amongst the earliest descriptions of the comparative anatomy of the Loricata, and may well have been the very first, in the case of the American Crocodile, it is of some interest to record and comment upon them here.

Sloane correctly noted the thick, quadrate dorsal scutes, and observed that crocodiles "are not to be pierc'd or thrust into but in the belly" (where the scales are not ossified). In this connection, he refers to Hakluyt (1600), who gives John Sarracoll's account of an incident in Sierra Leone, during the Earl of Cumberland's voyage in 1586: "Then wee returned to our boates, and tooke . . . reasonable store of fish, and amongst the rest we halled up a great foule monster, whose head and back were so hard, that no sword could enter it: but being thrust in vnder the belly in diuers places, and much wounded, hee bowed a sword in his mouth, as a man would do a girdle of leather about his hande, and likewise the yron of a boare speare." The "heel of Achilles," or soft belly, of the crocodile was already well known to the ancients (cf. Plin., *N.H.*, VIII, 38).

Sloane noted that the ribs "towards the abdomen were crooked, and made one with another the figure of lozenges"—a very fair description, in view of the marked angle which exists between the true ribs and the cartilaginous "sternal ribs" or haemapophyses.

Sloane remarked that, in the American Crocodile, the "flesh and eggs smell of musk so much, so as not to be good food." The musk-like odour of the crocodile was recorded by a number of early writers quoted by Bochart (1796): e.g., by the Arabian authors, Kazvini (13th century) and Damiri (14th century), who refer, respectively, to this characteristic odour of the eggs of *C. niloticus,* and of the animal itself; and by Pietro Martire Vermigli (16th century), who mentions the odour of musk said to be emitted by *C. niloticus* and *C. acutus.*

Sloane also found that "there were four glands, musk pods, or scent bags, two under the jaws, and two near the anus." Gadow (1901) states: "All the recent Crocodilia possess two pairs of skin-glands, both secreting musk. One pair is situated . . . on the inner side of the right and left half of the lower jaw. . . . The other pair lies within the lips of the cloacal slit, and is not visible from the outside."

The earliest reference to the anal musk glands of the crocodile (*C. niloticus*) appears to be that of the Arabian writer, 'Abd al-Latif (1800), in the 12th-13th century: "There is to be found, at the surface of its body, next to the belly, a gland resembling an egg, consisting of a sanguineous humour, which is, as it were, a vesicle containing musk;" and he was told, on good authority, that the best musk on the market was sometimes obtained from these glands, and that, in quality, the crocodile's musk was second to none.

The paired musk gland under the skin of the lower jaw was first described, in *C. acutus,* by Hernández who was in Mexico from 1593 to 1600—(and not, as stated by Cole (1944), by Recchi, whose summary of Hernández' observations was, however, the basis of the Spanish translation by Ximenez in 1615; the first published Latin edition of Hernández, by Recchi, appeared in 1628, but the latter's description of the crocodile is not part of his own commentary, and is identical with that given by Ximenez). Hernández (Ximenez, 1615) stated: ". . . there are to be found, next to the throat, in these animals, certain small glands resembling

beans, which emit a pleasant odour of musk."* These glands of the lower jaw were also observed by Duverney (1734), who, referring to Recchi's account, remarked that "there is reason to be surprised that this peculiarity was not noticed by the ancients."

Referring to the respiratory system of the crocodile, Cole (1944) states that an important point, which was noted neither by Goüye nor by Duverney, "is the presence at the back of the mouth of a palato-lingual velum which enables the animal, with only the tip of its snout above the surface, to fill its mouth with water, without interrupting a continuous flow of air into the lungs."

Borch (1674) stated that the epiglottis, in *C. niloticus,* "is seen to be very wide, and almost semicircular, closing the entire fauces," and von Hammen (1681) gave a similar description. Collins (1685) remarked that, in the crocodile, the epiglottis is "very broad, and of a semicircular figure, filling up the interstice of the fauces," and Cole (1944) observes that this "suggests that the modified type of epiglottis which is found in this animal was perhaps known to him." However, Cole (1944) has also very rightly stated that "it is unwise to attribute any discovery to Collins without searching for it in the works of his predecessors," and he adds: "It would be a laborious and merciless task to trace to their sources all the discoveries which Collins is supposed to have made. . . . [It is] difficult to believe that there is a single original observation of importance in the whole of this grandiloquent but meretricious compilation." There is evidence that Collins was acquainted with at least some of Borch's work (Cole, 1944), and his comments on the epiglottis of the crocodile would appear to be referable to the same author.

Although Sloane certainly did not appreciate the significance of the broad cartilaginous plate of the basihyal which rises in front of the glottis like an epiglottis, it is probable that he referred to this structure when he noted that "the windpipe was reflected."

Sloane correctly observed that the trachea, in *C. acutus,* forms a bend before dividing into the bronchi, and noted the well developed lungs ("two great lobes"), "which were nothing but vesicles with blood vessels intermix'd." This description compares well, for example, with that given by Gadow (1901): "Each lung is an oval sac, and is transformed into a complicated system of tubes, at the end of which are the countless honeycomb-like respiratory cells, the whole lung being spongy."

Sloane stated erroneously that the crocodile "had no tongue." The tongue of the crocodile, which is flat and thick, extending between the rami of the mandible, but is attached by its whole under-surface so that it can be elevated but not protruded, has been the subject of comment and, frequently, of error for many centuries. Some early writers (Herod., II, 68; Diod. I, 35) stated that the crocodile had no tongue. Pliny (*N.H.,* XI, 65) believed that the whole of the tongue adhered to the palate, and stated (*N.H.,* VIII, 37) that the crocodile "is the only animal that does not enjoy the use of its tongue." A careful appraisal of the observations of Aristotle appears to show, however, that, contrary to Duverney's assertion, this writer did not suppose any vertebrate to be absolutely tongueless, not even the crocodile: he compares the latter with fishes in which, he says, the tongue "is indistinctly separated from the rest of the mouth" (*P.A.,* IV, 11, 690b); and, in another passage (*P.A.,*

* ". . . se halla junto a la garganta, de estos animales, ciertas glandolillas semejantes a habas, que huelen, suauemente, a almizque. . . ."

II, 17, 660b), he clearly states that "the crocodile's tongue is adherent to the lower jaw," commenting that "it is the crocodile's lot, though a land animal, to live the life of a fish, and this again necessarily involves an indistinct formation of the part in question." Von Hammen (1681) described the tongue correctly, and Duverney (1734) observed that this organ, "being attached all around within the jaw by a covering membrane, cannot extend itself and protrude . . . as in other animals."

Sloane described the thick wall and "rugous" mucous membrane so characteristic of the muscular, gizzard-like stomach of crocodiles; he noted that this organ contained "many round smooth stones and sand, such as is on the sea shore"—apparently, a frequent occurrence in these reptiles (Owen, 1866; Reese, 1915). Borch (1674) had previously given a good description of the stomach of *C. niloticus,* stating that "its internal lining is rugous, and remarkably thick; within its cavity are scattered a number of small white, translucent stones, the size of a hazel nut." Sloane referred to Hakluyt (1600), who recorded that a crocodile in Sierra Leone "had nothing in his belly, but a certaine quantitie of small stones, to the value of a pottell," (i.e., two quarts). And Hernández, in the late 16th century, (Ximenez, 1615), was led to believe that the crocodile (*C. acutus*), "when hungry, or lacking other food, in order to eat, subsists on stones." Hunter (1861), in the 18th century, noted that, in a *C. acutus* from Jamaica, "there were stones in the stomach of considerable size, larger, e.g., than the end of a man's thumb." Cole (1944) remarks that Goüye "fails to recognize the unusual structure of the crocodilian stomach, . . . nor was he struck by its resemblance to the gizzard of a bird. In the second paper, however, this point is made by the more learned Duverney."

Sloane noted the duodenal loops, or "fine circumvolutions . . . near the pylorus," and that "into them was inserted the duct of the gall bladder"; and it is relevant to recall that, in reptiles, "it is only in the Crocodilia that a 'duodenal' portion of the intestine can be distinctly defined" (Owen, 1866). Both Goüye and Sloane mentioned the well marked convolutions of the small gut. Goüye stated that the "rectum" was the only part of the intestinal canal which was distinct from the remainder, and it is to be presumed that he was referring to the colon, which is definitely marked off in all reptiles, and is wide and short, and usually straight (Owen, 1866; Gadow, 1901). Similarly, Cuvier (1805a) stated that he proposed to apply the term "rectum" indifferently to the large intestine of reptiles and fishes, and that, in the Nile Crocodile, this structure is "cylindrical." What Sloane meant by the statement that "the rectum is divided as it were into joints," is not altogether clear: it is probable that he, too, was referring to the colon, which, in the crocodile, is marked off from the rest of the intestinal canal by the ileo-colic valve ("ad principium intestini recti observata est coli valvula"—Borch, 1674), and by the somewhat oblique entry into it of the ileum; and, moreover, that he believed that the cloaca, into which the rectum opens obliquely and by a valvular protrusion (Owen, 1866), was also part of the "rectum."

Sloane accurately recorded that "the diaphragma seem'd membranaceous, or rather tendinous or nervous," i.e., aponeurotic. In the crocodile there is no true muscular diaphragm, but there is a septum transversum formed by the capsule of the liver which, together with the peculiar "diaphragmatic" muscle (arising from the last pair of abdominal ribs),

is continued ventrally as an aponeurosis to the inner surface of the sternum (Gadow, 1901).

He described the long, triangular liver divided into two lobes, of which the right lobe is the larger, and "a great gall bladder, full of yellow thin bile." This latter observation is of interest because, in contrast to Owen's (1866) statement that the bile of most reptiles is green, Goüye expressed himself in almost identical terms, stating that the gall bladder of *C. niloticus* "was very large, and filled with a yellow humour." Hunter (1861) similarly noted that the bile of a "Water-Snake" (*Pelamis platurus* (Linné)) was "a pale clear yellow colour." Borch (1674) also commented on the large size of the gall bladder in *C. niloticus*.

Sloane failed to find the spleen, which may have been quite small. Indeed, although the spleen is an organ which tends to vary appreciably in size, in reptiles it is usually relatively small: some early writers already commented on the "extremely small" size of the spleen in amphibians and reptiles, including the crocodile (Arist., *H.A.,* II, 15, 506a; Plin., *N.H.,* XI, 80). In *C. niloticus,* Goüye found a spleen which was 4½ inches long and less than 3 inches wide; whereas Duverney recorded a spleen measuring only one inch in length and half an inch in width. Furthermore, the spleen in reptiles lies in the mesogaster or in the duodenal mesentery—as correctly noted by Cuvier (1805b) in the case of the crocodile—and thus, Sloane may, with mammalian anatomy in mind, have overlooked it in this situation. He noted that there were "several coaglomerated as well as separate glands" in association with the small intestine: these may, indeed, have included the spleen and the pancreas. In mammals, they would certainly include the abdominal lymph glands, but a search of the literature has failed to reveal any information on the existence of lymph glands in the Reptilia, and, according to present limited knowledge in this field, lymph nodes appear to be, for the most part, a specialized mammalian type of structure (Romer, 1949).

Sloane gave a reasonably accurate description of the kidneys of the crocodile, observing that they were situated near the anus, and "fix'd to the spine," and that they were "like a Bears, and in their surface resembled the gyri of the brain," appearing to be "in several sections." This may be compared with Owen's (1866) statement that, in crocodiles, the surface of the kidney "is convoluted, like the brain, but with smaller and more numerous gyri." The comparison drawn between the markedly lobulated kidney of the crocodile, and that of a bear, is reasonable, for, in Bears and certain other mammals (Ox, Seals, Cetacea), "the kidney is divided externally into a number of distinctly separated lobules" (Parker & Haswell, 1940). Indeed, it is interesting to note that the completely lobulated kidney of the bear was first engraved by Eustachius (Eustacchi) in 1552, and published in 1563; and that C. Perrault, in 1669-76, compared it with the lobulated kidney of the otter, and the superficially lobulated kidney of the porpoise and new-born human infant, and noted the similar appearance of the kidney of the common seal, *Phoca vitulina* (Cole, 1944). Sloane also noted that the testes of the crocodile were elongated and reddish "and lay over the kidnies."

Unfortunately, Sloane did not attempt to investigate or observe the very special structure of the crocodile's heart, which has attained the highest state of development of all reptiles: there is a complete division of the ventricle, but there still remains a small communication between the two aortae, where their walls are in contact on leaving the ventricles.

Sloane merely noted that the heart had two large auricles, a fact already observed by Borch (1674) ("auriculae cordis grandiores"); and Reese (1915) states that "the auricles are very large in proportion to the ventricles."

Duverney, who wrote quite lengthy accounts of the alleged structure of the heart of *C. niloticus,* failed to describe this organ with any degree of accuracy, and "it is surprising that an anatomist capable of working out correctly the structure of the truncus arteriosus of the frog should have failed to discover the imperforate interventricular septum of the crocodile"—although it is true that he also stated that the frog's heart has but one auricle (Cole, 1944). Indeed, Duverney's second account (Goüye, 1688), which differs appreciably from his first description (Duverney, 1734), appears to have been based, not on the anatomy of the crocodile's heart, but on that of a marine turtle (Méry, 1705; Cole, 1944). The account of the crocodilian heart, in *C. niloticus* and *Alligator* sp.. ("Caiman"), given by Cuvier (1805b), is as erroneous as that of earlier writers. It is, indeed, remarkable that the first accurate description of the cardiovascular system of the Loricata was that given by an American, Richard Harlan (1825), in a paper on *Alligator mississippiensis* (Daudin), presented to the American Philosophical Society in Philadelphia, in 1820. Harlan, who translated and criticized the erroneous description of the crocodilian heart given by Cuvier (1805b), wrote: "The parts composing this organ are two auricles, two very distinct ventricles . . . I have proved, if my observations are correct, that there are two ventricles, very distinct, and having no manner of communication from one to the other through their partition; only nature has placed a large arterial tube (the left or splanchnic aorta), which has a communication with the right or systemic aorta, and which being capable of great distention, when filled with fluid, empties part of its contents into the right aorta." It will be noted that Harlan is also the first to describe what is generally known, in scientific literature, as the "foramen Panizzae." Further accurate accounts of the cardiovascular system of *A. mississippiensis* appeared a few years later (Panizza, 1833; Bischoff, 1836).

Sloane recorded that, in his specimen, which died in captivity, "the heart was little" and "had a pericardium, in which was a great quantity of water"; and, although Harlan (1825) similarly notes that the pericardium of *A. mississippiensis* "contains . . . a large quantity of lubricating fluid," and von Hammen's (1681) observations, in *C. niloticus,* were comparable ("cor pericardio denso circumdatum, quo dissecto, aqua profluebat"), it is interesting to speculate as to whether the cause of death, in Sloane's specimen of *C. acutus,* may not, perhaps, have been serous peritonitis, possibly the result of some pneumococcal or tuberculous infection.

Finally, Sloane noted that "the eye was cover'd below with a strong membrana nictitans" and that "the pupil was long like a Cats." Already, before 1675, Swammerdam (1738) had stated that, "in the crocodile—a fact, indeed, not previously recorded—the eye is feline, the aperture of its pupil reverting, in the daytime, as it were to an oblong slit." In the Loricata, which have nocturnal predatory habits, the pupil contracts into a vertical slit and is capable of great dilatation, and the nictitating membrane is very highly developed (Cuvier, 1800; Walls, 1942; Rochon-Duvigneaud, 1943).

The author wishes to acknowledge his indebtedness to Dr. A. d'A. Bellairs, of the Department of Anatomy, University of Cambridge, England, for comments and criticisms on this paper.

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Classical references:—
Arist. = Aristoteles — *H.A.* = Historia Animalium.
P.A. = De Partibus Animalium.
Diod. = Diodorus Siculus, Bibliotheca Historica.
Herod. = Herodotus, Historiae.
Plin., *N.H.* = G. Plinius Secundus, Naturalis Historia.
(Roman numerals = Book; Arabic numerals = chapter.)

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Methods of Field Study in Reptiles*

By ANGUS M. WOODBURY

Nearly all study of reptiles is based upon field work but some of the studies in laboratory and museum become so far removed and so remote from natural ecological conditions of the field that there seems to be a growing tendency to check results obtained in laboratory and museum with those obtained in the field. This is in accord with the scientific approach and consequently there is a movement in many directions to develop accurate means of observation or field experimentation.

It is much more difficult to set up standard conditions in the field than in the laboratory because there are so many variable factors that can not be controlled. Usually the animals have to be studied in a dynamic flux of factors that are continually at work affecting their well being. This makes it difficult to analyze causes and assign values to the various factors.

And yet this is the thing that gives to field work such importance. In the field, there is so much exchange of materials and energy with the environment, that the balance is unavoidably upset when animals are taken into a laboratory. If specimens are taken into a museum, the living aspects are obliterated and only the morphological combination of characters is left. The field work offers opportunity to study animals as living dynamic beings struggling with environmental factors and winning or losing as the tide of battle surges back and forth.

In study of behavior and social relations, certain problems can be taken into the laboratory but field work is a must for study of natural relationships. A few years ago, an organization was formed for the study of animal societies under natural conditions. This is a recognition of the need to supplement the immense laboratory program with back to nature studies.

Much field work of the past has consisted of collecting specimens here and there in the field, taking them into the museum where morphological characters of the specimens gives some clues to inter and intraspecific relationships and where the localities of collections gives some idea of geographic distribution and range. This has proved to be a good solid foundation, but only a foundation and not a superstructure for understanding taxonomy. Further enlightenment is most likely to come from field work.

Miscellaneous collections of specimens have in many cases been supplemented by planned collections in critical areas where specimens will help to clear up questions of intergradation, hybridization or overlap. Sometimes it is necessary to examine populations in the field to ascertain such relationships, especially where ecological conditions in habitat or niche are necessary to proper understanding.

In recent years, it has become obvious that specimens can be made to serve additional purposes if in addition to place or locality needed for plotting geographic distribution, the ecological habitat or niche be also recorded on the tag with the specimen. This allows plotting of the ecological distribution which in many cases is as vital as geographic distribution. To make this effective, however, requires a stable ecological taxonomy that everyone can use (Woodbury, A. M., Science, 1952 (2992):3) May.

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* Paper given at AAAS meetings in Corvallis, Oregon, June, 1952.

In studying reptiles in the field, it must always be kept in mind that it is the ecological and social relationships that are hardest to discover and should form the central core in the majority of field studies. One of the most critical and difficult aspects in such studies is the problem of keeping individual animals identified and recognized. One of the best means for this purpose is the marking of animals so they can be individually identified and data recorded about each one over a long period of time.

Many observations have been made of individual animals that could be individually recognized from some peculiarity, such as a regenerating tail, a crippled foot, a particular location or other recognition character. This, however, is inadequate as a regular procedure and hence ways of artificially marking individuals has come into vogue.

Many schemes have been devised to provide such individual identification. Among lizards, various combinations of toes clipped is an easy and useful method used by many people. By clipping 1, 2, 3 or 4 toes on different feet in different combinations, several hundred lizards could be individually identified. It is convenient to letter the feet, number the toes and give the sex in designating lizards, thus A2D3 ♀ indicates that the second toe of left front foot and the third toe of the right hind foot of a female were clipped. It is conceivable that toe clipping might be deleterious to the safety of lizards but apparently specimens survive without much indication of harm to them.

Among snakes, two principal methods of marking are scale clipping (Blanchard and Finster, 1933) and tattooing (Woodbury, 1948: 127-128 and 1951: 5-7). The method of scale clipping used by Blanchard in Michigan and others is a simple method which can be used in the field with very little difficulty. For equipment, this method requires only a pair of small scissors which can be carried easily on the person. Ends of the ventral plates are clipped in various combinations. Certain precautions are necessary for accuracy. At least one case (Conant, 1948) has been reported in which the clipped scales regenerated in 4 or 5 years, thus throwing doubt upon its reliability.

Ordinarily the anal plate in front of the transverse vent is used as the point of reference. Counting forward from that point and clipping either the right or left ends of the ventral plates gives opportunity for several hundred, or even thousands of different combinations that will give individual identification. A convenient way of indicating the points clipped is to represent plates running forward from the anal plate by letters of the alphabet, using a capital letter for the end of the plate on the snake's right side and a small letter for the other end.

Thus, if the fourth plate is clipped on a female snake's right side, and the seventh on the snake's left side, it would be designated as Dg ♀. Similarly a designation of Bek ♂ would indicate a clipping of the second scale on a male snake's right side and of the fifth and eleventh scales on the snake's left side. In this method, there is the ever-present danger of miscounting plates or mistaking right or left ends of plates either in making the original records or in identification when recaptured.

The other method consists in tattooing individual numbers on snakes. This requires a portable battery operated tattoo outfit suitable for field work. The power must be sufficient to drive the tattooing needles through the scales and leave ink underneath. Numbers may be written on any smooth light colored surface where colored pigments do not obscure the ink, such as the throat region or the base of the tail.

In this method, there is the ever-present danger of mis-reading the numbers when recaptured. For this reason, great caution should be exercised in making the figures when tattooing at the time of the first capture. The free ends of such figures as 2, 3, 4, 5, 6 and 9 should be made extra long to aid in distinguishing from each other and from figure 8 without any free ends. If once properly tattooed so there can be no mistake in reading, the number will serve as a positive permanent identification. Neither method handicaps the snake after recovery from the operation of marking.

Turtles with their hard shells offer other methods of marking. They are difficult to tattoo although the method has been tried on soft parts. Toe clipping has been used but seems best suited as an auxiliary to methods of marking the shell. Shell marking offers promise of greatest usefulness. Painting, carving, branding and grinding edges are methods that have been tried.

Painting the carapace of land tortoises has been used by many amateur naturalists. Woodbury and Hardy (1948: 149-150) painted various combinations of plates using various combinations of colors for individual identification but found that the colors began to wear thin after a year or two and discarded the method in favor of branding. However, one red-painted tortoise that did not get branded was definitely identified by means of the paint more than 8 years later.

Branding tortoises with a hot wire heated in a small fire as needed proved to be a practicable way of marking that was more or less permanent if properly done. There are, however, some dangers inherent in the method and some precautions to be taken. If the burning of the shell goes too deep and affects the underlying tissue, it initiates a slow process of regeneration which after a few years completely replaces the burned area and obliterates the brand. This can be avoided by using a white-hot wire of about 12 or 14 size and burning the shell so quickly that the heat does not damage the underlying living cells.

In practice, it is convenient to put a brand on various plates or combination of plates. A convenient method of recording the combinations used is to designate the vertebral plates by capital letters, A to E, the costals by numbers 1 to 8 and the marginals by small letters a to y as shown in the figure. An individual can then be cited by giving the combination of plates branded followed by the sex symbol, thus De♀, B6♂, A5r♂, 5g♀, ev♂.

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John T. Nichols of the American Museum used a method of carving numbers on plates of turtles and found that the numbers were distinct after 10 or 15 years on turtles that did not molt the outer plates. On tough-shelled turtles, this would be a slow and difficult procedure if carved by hand.

A method of marking turtles by making notches in the edge of the marginals was developed by Fred R. Cagle (Copeia, 1939: 170), in which scissors and files were used but later (Mus. Zool., Univ. Mich., 1944: 7) a power grinder where electricity was available was suggested as much more efficient in making the notches. As a substitute for this last item, a small portable hand grinder might be carried in the field where there is no available source of power.

Cagle reported that scissors were useful in making notches on small unossified shells but often split the carapace on those that were partly ossified, sometimes resulting in permanent damage. Hard shells had to

be sawed or filed but when such notches were once established, they appeared to be permanent identification markers that did not interfere with normal activity of the turtles. These notches could be used only on the free edges of the marginal plates and not on those connected to the plastron.

He suggested numbering the marginals separately on each side beginning with the plates next to the nuchals, but probably an improvement would result from lettering the plates as suggested for snake clipping, using capital letters on one side and small letters on the other. He calculated that 16 turtles could be marked by making a notch on only one plate, 120 by using two plates on each, 560 by using three and 1820 by using four, a total of 2516 possibilities.

The previous methods of marking have been designated for permanence but for studies of molting, sometimes auxiliary marks are useful. Fitch (1940: 152) reported marking lizards externally with indelible ink which was shed at the next molt. Those that retained the ink until subsequent capture were known not to have molted but those that had lost it were known to have molted at least once.

In the author's work with a snake den in Tooele County, Utah, a method was developed of marking rattles on rattlesnakes with a cuticle or keratin-staining red dye which was useful in determining the number of rattles added and consequently the number of molts that had occurred since the staining was done. This helped greatly in adding certainty to the method of determining ages of rattlesnakes by means of rattles as developed in that study. (Herpetologica 1951, 7: 28-40).

Marking reptiles for individual identification generally requires capture of the specimens so they may be marked and processed to get data desired. Capturing reptiles by hand is generally a tedious and time consuming process and hence has led to the development of more efficient methods by the use of special techniques, tools and traps. Many ingenious devices have been suggested.

For capturing small lizards that hide in bushes, cautious and careful slow movements are essential. A pair of long forceps or a stick from a native bush can be pushed slowly toward the lizard and pin down a foot. For those out in the open, a toy rubber throwing gun or a sling-shot full of coarse sand or fine gravel may sometimes stun a lizard so that it can be picked up but ordinarily a large percentage of such cases prove detrimental or fatal.

Probably the most useful methods are trapping. Wm. Vogt (1941: 115) suggested a lizard trap consisting of a flat box about 1 meter square and 5 centimeters (2 inches) high with a screen bottom, a screen funnel opening in one corner and a door in the opposite corner. To empty the trap, turn it over and open the door into some dark container into which the lizards can run. Set the trap in the open, in an area where lizards occur. Acting as a shelter, it entices the lizards through the funnel without bait.

R. H. Imler (1945) suggested a method of capturing snakes by setting funnel traps along a mesh wire fence. Snakes upon running into the fence tend to follow it along and enter the funnels into the traps. This method has been applied in various ways, notably by Fitch in his ecological studies at University of Kansas and by the author in his Tooele snake den studies, University of Utah (1951).

In the latter case, a screen wire fence about 330 feet long was used to

enclose a cobblestone rock area where hundreds of snakes went underground for winter and emerged in the spring to spread out over surrounding territory. Funnel traps opening outward through the fence in the spring and inward in the fall captured the snakes coming and going.

The capture of reptiles offers a golden opportunity to gather useful information about them while they are being processed. Measuring and weighing are common methods that yield information of increasing value with the increasing data. These methods require equipment suitable for the purpose and results intended. Flexible steel tapes graduated in millimeters and inch fractions in pocket size cases are handy for gross measurements but calipers of different sizes with similar graduations are essential for more precise measurements or for direct measurements of length of a chord through instead of arc around curved surfaces.

Routine measurements usually include body and total lengths of lizards and snakes as well as any other set of minor measurements desired for special study. With turtles, it is usually desirable to get measurements of length, width and depth of the shell and certain other special measurements.

The problem of weights is more difficult because of the difficulty of carrying suitable scales or balances in the field. Total weight taken at successive times yields information of value if due consideration is given to food intake and excretion. Weights taken before and after hibernation when the food problem is not involved gives some idea of loss in weight during hibernation. Weights taken before and after the active summer season give some idea of increase during that period but the best idea of growth in weight comes from comparison of weights either before or after successive hibernations.

In addition, valuable information can be obtained from reptiles by counting scales or other structures for special purposes or in some cases by palpation of certain lizards and snakes. By manipulating the thumb carefully over the abdomen of females, it is often possible to detect or even count large eggs in ovary or oviduct.

Accumulation of such information is, per se, only a foundation from which significant ideas can be derived. It is inadequate use of such data to stop with tables of measurements, weights or counts. It is the integration of such information into thinking schemes about reptiles that is important. Will it answer such questions as How fast does the snake grow? Does it continue to grow all its life or does it attain an adult stage? What is the potential ability of reproduction? What are the steps in the complete life history of an individual? How large is a home range? Does one home range overlap another or are they set up in territorial fashion? Are there any social attractions between numbers? and so on.

When such questions can be answered, field studies will yield results of significance.

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Case History of a Snake with an Irregurgitable Artificial Egg

By HOBART M. SMITH

On March 23, 1946, Todd Willis, a student at Texas Agricultural and Mechanical College, brought me a freshly captured Common Ratsnake (*Elaphe obsoleta lindheimeri*) with an artificial nest egg in the stomach. We kept the snake alive in captivity for several months, during which time we had an unusual opportunity to observe the influence of the egg upon diet and the hopelessness of natural regurgitation.

The snake was found in a hay mow on a farm 4 miles south of College Station, Texas, where it apparently had spent the winter. It was thin and extremely irritable—even more irritable than examples of this species, notoriously nervous at best, usually are. An old wound, largely healed, was present on the skin stretched over the front end of the egg. The snake weighed 638 g., and measured 1545 mm. in total length.

The length of time the egg had been in the stomach is not known, but is thought to have been about five months. No artificial eggs had been used for years on the farm where the snake was found. The nearest farm where they were used was about a mile away. Since the snake was apparently in hibernation, it seems likely that the egg was ingested no later than the preceding fall. Subsequent events, proving that the snake could feed successfully even though the egg remained in the stomach, indicate that the egg could have been in the stomach for years without causing the death of the snake. The abdominal scar in front of the egg adds some weight to the supposition that the egg must have been present at least a short time before hibernation began.

The immediate question of why the snake did not regurgitate the egg is inescapable. Gans (Zoologica, vol. 37, 1952: 214, 215), in reviewing the habits of the egg-eating *Dasypeltis* concludes it is doubtful that this snake would ingest something it could not regurgitate. The same view would normally be justified for any other snake, for all characteristically regurgitate food objects of any size when they cannot be digested or when the snake is excited. The snake here discussed is positively known to be an exception to the general rule. Shortly after acquisition of the snake, I tried to force the egg forward in the digestive tract, but concluded it was held by an at least partial adhesion to the stomach wall. The egg could be forced forward an inch or slightly more, but the stomach wall appeared to move with it. Released, both returned to their former position. The egg measured 46 mm. in width, including the thickness of the very thin body wall on either side. It stretched the skin rather taut so the scale rows were widely separated. Unfortunately no measurement was taken of the body diameter in front of the egg, or of the head width. The difference was assuredly great enough, however, to render very difficult either voluntary or involuntary movements of the egg, even without the adhesion. Perhaps at one time the snake could have regurgitated the egg, but when Willis found it regurgitation was clearly impossible. Subsequent events corroborated this conclusion.

With an adhered egg in the stomach, some doubt existed whether the snake could feed successfully. The egg certainly very nearly occluded the alimentary tract, and the emaciated condition showed that starvation was

in progress. Copious quantities of fecal matter were released when the snake was captured, but whether these feces were the residue of a feeding before or after the egg was eaten was indeterminate.

To test the snake's digestive ability, food was offered at irregular intervals throughout the duration of its captivity. The results of part of this period are tabulated below.

Date	*Remarks*	*Food Accepted*
April 4	Regurgitated April 5	1 English sparrow (20 g.)
April 5	Regurgitated April 5	1 English sparrow (15 g.)
April 7		1 white rat (49 g.)
April 9	Defecation	——
April 13	Defecation	——
April 16	Killed but not eaten	1 white rat (25 g.)
April 18	Regurgitated	——
May 9		1 black mouse (29 g.)
May 12	Defecation	——
May 15		1 English sparrow (16 g.)
May 17	Defecation	——
May 21	Regurgitated	2 black mice (total 57 g.)
May 21	Defecation	——
May 27	Regurgitated	1 black mouse (21 g.)
May 28	Regurgitated	1 black mouse (15 g.)

The results show that food could be digested and could pass the egg, although large and/or coarse food objects caused some trouble and were often regurgitated.

The food had more effect than simply staving off starvation. The egg was eventually worked free from the stomach wall, a fact of which we became aware when the snake for the first time was observed attempting of its own volition to regurgitate the egg. Dr. Bryan P. Glass, then of Texas A. and M. College, kindly made the following notes: "First seen in violent convulsion with egg already moved approximately 8 inches forward of previous site. The snake would bend the body sharply behind the egg and with strong muscular contraction force it forward. In about 5 minutes the egg was moved 6 inches. Then when the egg was about 8 inches from the mouth, the violent movements ceased, apparently from exhaustion. The snake laid breathing deeply with mouth partly open. After a long rest period the egg was forced back down the stomach by slow, calm movements. It took only about 5 minutes to restore the egg to its accustomed position. Fifteen minutes later the snake had regurgitated the egg again, this time to a point about 5 inches from the mouth. The body was thrown into a tight angle behind the egg, while the snake opened and closed the mouth as if gagging, rolled over, threw angles back of the egg, first to one side and then the other, giving every sign of exerting the absolute maximum of effort to regurgitate the egg. The efforts were completely without further success. Rest periods became frequent and longer, and eventually the egg was again swallowed. A short time later the snake was trying, apparently, to force the egg into the intestine, again without success."

A few days later we observed the snake again attempting unsuccessfully to regurgitate the egg. In early June I tried to force the egg for-

ward by hand, and successfully gained the same maximum forward position the snake had attained by itself. The egg would not budge beyond that point. The skin was stretched to the very maximum at this point, as attested by the fact that it soon parted as we continued to try to force the egg forward. The oesophagus was then cut and the egg (a wooden one) was removed. The oesophagus was tucked back in position and the slit in the skin was sewed up with ordinary thread.

Food was not offered again for another three weeks (June 27) when the snake moulted and accepted two mice (one regurgitated). On each day, July 3, 5, 6, 7, 8, 9, 10, 12 and 14, the snake accepted a mouse, and on July 13 a dead Red Bat. None were regurgitated. Shortly thereafter the snake escaped.

SUMMARY

1. An *Elaphe obsoleta lindheimeri* swallowed an artificial nest egg under natural conditions and retained it in the stomach for at least 4 months (probably 6 months or more).

2. The snake could not regurgitate the egg, and under natural conditions would probably not have done so unless growth were to have rendered the snake large enough to handle it.

3. The egg did not prevent acceptance and digestion of food, which passed around the egg; it did seem to necessitate small meals and rejection of coarse food such as small birds with large quantities of undigestible parts (as feathers).

4. Removal of the egg through the side of the œsophagus in the neck region resulted in complete recovery of the snake.

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The Generic Name of the Newts of Eastern North America

By HOBART M. SMITH

The generic name for the newts of eastern North America has been subjected to frequent change for the past century or more, with synoptic works such as that of Boulenger (1882) using *Molge,* Cope (1889) *Diemyctylus,* Stejneger and Barbour (1917) *Notophthalmus,* Stejneger and Barbour (1923 *et seq.*) *Triturus,* and Smith and Taylor (1948) *Diemictylus.*

Most of the confusion has arisen from disagreement upon the generic relationships of the many species of the Holarctic family Salamandridae. Wolterstorff and Herre (1935) first clearly analyzed the generic picture, placing eastern North American newts in the genus *Diemictylus,* the western ones in *Taricha.* Not until recent months, however, following a series of publications chiefly by European herpetologists on the subject, has this generic partition been accepted by American students (*cf.* Smith and Taylor, 1948; Brown, 1950; Bragg, 1952; Schwartz and Duellman, 1952). The biological as well as anatomical evidence (Herre, 1936, 1939, 1945, *et al.*; von Wahlert, 1952) seems overwhelmingly corroborative of the partition proposed by Wolterstorff and Herre.

The nomenclatural instability of the eastern newts has not been wholly a matter of systematic uncertainty, however; there has also been a strictly nomenclatural problem. The earliest names applicable to the eastern newts and admissible as generic names are Rafinesque's subgenera (of *Triturus*) *Diemictylus* (1820: 5, line 8, type *viridescens*) and *Notophthalmus* (*idem,* lines 26-27, type *miniatus*). Hallowell (1856: 11, 1858: 362) was apparently the earliest reviser clearly to select *Diemictylus* and synonymize *Notophthalmus* with it, although an orthographic alternative is there proposed in the form of *Diemyctylus.* Cope (1859: 126; 1889: 202) likewise uses *Diemyctylus* (adding an erroneous spelling change of *Diemychylus* on page 128), and in 1907 Stejneger (p. 15) also adopted *Diemictylus,* although in a broader sense than now used, including Japanese species currently referred to *Cynops.* Even in 1935 Wolterstorff and Herre, in their original paper on generic partition of the newts, utilized *Diemictylus.* More recent American usages stem from the precedent furnished by these authors.

Yet, in recent years, European herpetologists (*e.g.,* Mertens, 1951; von Wahlert, 1952) consistently use *Notophthalmus.* In response to my query on the matter of conflicting views on the proper generic name, Dr. Wolf Herre kindly advised that as indicated in his paper of 1936 (footnote p. 195) Stejneger was the one who first pointed out to him, in a personal communication received subsequent to the appearance of the original Wolterstorff-Herre generic analysis, that *Notophthalmus* is the correct name. For elaboration of this view Stejneger referred to the able discussion by Gill (1907: 256) of precisely the point here in question: the propriety of *Diemictylus vs. Notophthalmus.* Gill concluded (and apparently won agreement from Stejneger) that *Notophthalmus* is the correct name on the premise that the selection of the "first reviser" takes precedence over line priority (as is clearly stated by the International Rules on Zoological Nomenclature, Article 28.*)

*"A genus formed by the union of two or more genera or subgenera takes the oldest valid generic or subgeneric name of its components. If the names are of the same date, that selected by the first reviser shall stand."

Were the previously cited papers by Hallowell the first, there would now be no taxonomic question. Unfortunately, however, Baird had, six years earlier (1850: 284), selected *Notophthalmus* (changed in spelling to *Notopthalmus*) and synonymized with it the name *Diemictylus.* He is clearly a reviser, and apparently is the first. Baird's selection was upheld by Gray (1850: 22), utilizing the original spelling of *Notophthalmus.* A few years later Gray (1858: 138) again used the name, but this time in the modified form of *Notophthalma.* The conclusion seems inescapable that the correct generic name for the eastern newts of North America is *Notophthalmus,* at least under under existing rules. The most important synonymic names and references may be summarized as follows.

Notophthalmus Rafinesque

Triturus (*Notophthalmus*) Rafinesque,, 1820: 5, lines 26-27 (type by monotypy *Triturus miniatus* Rafinesque).

Notopthalmus Baird, 1850: 284 (establishment of this name, rather than *Diemictylus,* by rights as first reviser) (an invalid emendation).

Notophthalmus Gray, 1850: 22 (acceptance of Baird's cited restriction).

Notophthalmia Gray, 1850: 22 (apparently an erroneous spelling change).

Notophthalma Gray, 1858: 138 (an invalid emendation).
Triturus (*Diemictylus*) Rafinesque, 1820: 5, line 8 (type by monotypy *Triturus viridescens* Rafinesque).
Diemictylus Baird, 1850: 284 (suppressed as a synonym of *Notophthalmus* by choice as first reviser); Gray, 1850: 22 (Baird's cited suppression accepted).
Diemyctylus Hallowell, 1856: 11 (an invalid emendation; selection in preference to *Notophthalmus,* the type species of which is suppressed as a "probable" synonym of D. *viridescens,* although the generic name *Notophthalmus* is not cited); *idem,* 1858: 362 (definite selection of *Diemyctylus* and suppression of *"Notopthalmus"*).
Diemychylus Cope, 1859: 128 (an erroneous spelling change).
Diemyctelus Gunther, 1901: 294 (an invalid emendation in synonymy of *Molge,* to which some species of *Notophthalmus* were referred).

The spelling variants of the original names *Diemictylus* and *Notophthalmus* are of varying taxonomic status (*cf.* Bull. Zool. *Nomencl.,* 7, 1952: 54, 58). The "erroneous spelling changes" (*Notophthalmia* and *Diemychylus*) have no taxonomic status; each "invalid emendation" is "to take priority as from the date it was published," and "to be attributed to the author by whom it was published." In view of the etymological origins of the two names as explained by Gill (1907) there is no reason for regarding any of the spelling variants of either name as valid emendations, which are to be accepted in substitute for original orthographies only in special cases (Bull. Zool. Nomencl., 7, 1952: 55-56).

A question bearing upon the acceptability of *Notophthalmus* follows from the recent proposal (Bull. Zool. Nomencl., 4, 1950: 330-331) that all names be determined by absolute priority, even line priority or if necessary word priority, and not by selection of first reviser, unless ruled otherwise by the International Commission. Although very little literature has been built up about either generic name, especially in this country, retention of *Notophthalmus* is I believe the most desirable course. A proposal for its retention has been submitted to the International Commission and upon publication in the Bulletin of Zoological Nomenclature notice of personal approval or disapproval may be sent to the Commission's secretary by any interested zoologist. Until a decision is rendered, maintenance is recommended (in accordance with the sentiment expressed by the Commission and recorded in the Bull. Zool. Nomenclature, 4, 1950: 329) of the currently approved herpetological practice; only *Notophthalmus* has received approval, and should thus be the generic name accepted for the interim.

The generic names are not the only ones involved in the present taxonomic tangle, however. The two names *Triturus viridescens* Rafinesque, 1820 (line 3), and *Triturus miniatus* Rafinesque, 1820 (line 17) are now regarded as synonyms, both applying to the same subspecies (the former was based on the aquatic stage, the latter upon the terrestrial stage). It is curious and unfortunate that the type species (*T. miniatus*) of the generic name now accepted (*Notophthalmus*) should be a junior synonym (by the rule of priority currently accepted; *cf.* Bull. Zool. Nomenclature, 4, 1950: 330-331) of the type species of the invalid generic name *Diemictylus.* Were the generic selection of the first reviser construed to fix the priority likewise of the specific names involved, the specific trivial name *miniatus* would have to be substituted for *viridescens.* Yet in view of the wide acceptance *viridescens* has had for nearly a cen-

tury, a substitution of any other name for it would be highly undesirable. Fortunately, however, selection between two polytypic genera certainly could scarcely thereby establish priority of the associated trivial names; the same view of monotypic genera follows as a matter of course. Genera and species should thus be considered quite separately in questions of priority. If this is granted, then *viridescens* is quite properly to be regarded a senior synonym of *miniatus*, on grounds both of line priority and of first reviser. Hallowell (1856: 11; 1858: 362) provisionally, and Cope (1859: 126) definitively, were the first to synonymize the two names, each selecting *viridescens* (in the combination *Diemyctylus viridescens*) over *miniatus*. A request on these grounds irrevocably to fix *T. viridescens* as a senior synonym of *T. miniatus* accompanies the application to the International Commission on Zoological Nomenclature for suppression of *Diemictylus*.

The species and subspecies of *Notophthalmus* currently recognized should thus be known as follows, pending approval by the International Commission on Zoological Nomenclature.

Notophthalmus kallerti (Wolterstorff)
Notophthalmus meridionalis (Cope)
Notophthalmus perstriatus (Bishop)
Notophthalmus viridescens Rafinesque (Baird, 1850)
  Notophthalmus viridescens viridescens Rafinesque (Herre, 1936)
  Notophthalmus viridescens dorsalis (Harlan)
  Notophthalmus viridescens louisianensis (Wolterstorff) Herre 1936
  Notophthalmus viridescens piaropicola (Schwartz and Duellman).

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Lizards and Turtles of the Mexican State of Morelos

By WILLIAM B. DAVIS and HOBART M. SMITH

During the summers of 1949 and 1950 the senior author and some thirty of his students conducted a survey of the land vertebrates of Morelos in cooperation with Srs. Luis Macias and Bernardo Villa of the Mexican Department of Game. In the course of these studies, 804 lizards and one turtle were collected and preserved. These represent 20 species, 6 of which have not been reported previously from the state. One subspecies of *Phrynosoma* and one species of *Cnemidophorus* were new to science.

Of some interest is the fact that we did not find seven of the 21 species previously reported for the state (see Smith and Taylor, 1950) as follows: *Ameiva undulata sinistra, Cnemidophorus guttatus immutabilis, ? Enyaliosaurus clarki, Eumeces indubitus, Gerrhonotus liocephalus liocephalus, Heloderma horridum,* and *Sceloporus siniferus siniferus.* These species are either erroneously recorded for Morelos or they occur in highly restricted localities and were overlooked by Davis and his parties.

Assuming all previous records are reliable, 26 lizards and one turtle are now known to occur in this small state in the Upper Balsas Basin.

MAJOR ECOLOGIC DIVISIONS

Morelos is one of the smallest Mexican states, with an area of 4,964 sq. km. It lies on the southern slope of the transverse belt of mountains just south of Mexico City and comprises parts of the Balsan and Austro-occidental Biotic Provinces as outlined by Smith (1949a). Altitudinally, the state varies from an average elevation of near 10,000 feet along the northern boundary to near 2,500 feet at the southern. The terrain is dissected by four major valleys, separated by low mountains, that run in a general north-south direction.

The Austro-occidental Biotic Province occupies the northern part of the state above the 6,000 foot contour. Here one finds two major plant communities—(1) the pine-fir forest, which begins at timber line on Mt. Popocatepetl at about 14,000 feet and descends to about 8,000 feet, at which elevation the (2) mixed forest (pines and numerous oaks) takes over and merges with the lower brushlands. Numerous park-like meadows occur in the pine-fir forests in which sacatón (*Festuca* sp.), bunch grass, is dominant. Suitable areas in both the coniferous and mixed forests are devoted to farming, corn being the chief crop.

Ecologically the Upper Balsan Basin Biotic Province falls naturally into three divisions—(1) desert scrub, characterized by thorny shrubs and numerous cacti, (2) riparian, characterized by tall broad-leafed trees, vines, and numerous herbs, and the (3) extensive rice and sugar cane fields, which simulate marshlands and have a nearly typical marsh fauna.

ACCOUNTS OF SPECIES

Coleonyx elegans nemoralis Klauber

Specimen examined: 8 km. NE Temilpa, 1.

This specimen is of particular interest because it is the first record of *Coleonyx* from the central semi-arid region of southern Mexico. All other specimens have been taken in the tropical coastal sections of Colima and Guerrero. Our specimen was found on August 18, 1950, a couple of days after a heavy rain, under a rock in a region that is definitely xeric in character, yet with faunal affinities with the tropical Pacific coast as evidenced by the presence of the boa, *Boa constrictor imperator,* the lizard *Ameiva undulata sinistra,* the skink *Mabuya mabouya mabouya,* and such resident birds as the barred quail, *Philortyx fasciatus,* and the magpie-jay, *Calocitta formosa formosa.* This record of *nemoralis* suggests the possibility of the union of its range with that of *C. e. elegans* considerably north of the Isthmus of Tehuantepec (see Klauber, 1945). Intensive searching during the summer rainy season in the highlands may reveal that the species is not uncommon. This specimen is referred to *nemoralis* on the basis of (1) upper prenasals not in contact, and (2) geographic position. The specimen is immature, 48 mm. in snout-vent length.

Anolis nebulosus (Wiegmann)

Specimens examined: 10 mi. NE Cuautla, 1 female; 20 km. NE Cuautla, 1 male. Additional record: Cuernavaca (Günther, 1885-1902).

The female, which was found on the ground on a rocky slope, measured 39 mm. in snout-vent length and contained two large eggs, 9 mm. in length. The male, found on the trunk of a pine tree, measured 46 mm. in snout-vent length and had testes 2 mm. in diameter. This appears to be a rare species in Morelos.

Ctenosaura pectinata (Wiegmann)

Specimens examined: Alpuyeca, 2 adult females, 4 yg.; El Rodeo, 1 adult male, 4 yg.; 6 mi. NW Alpuyeca, 1 yg.; near Puente de Ixtla, 3 yg.; 2 km. S Jonacatepec, 1 adult female, 2 subadult females, 4 yg.; 12 km. NW Axochiapan, 2 half-grown females, 4 yg.; Temilpa, 1 adult female. Additional records: 5 km. S Cuernavaca; 10 mi. S Cuernavaca (Smith, 1949b); Yautepec (Smith, 1939b).

Locally known as iguanas or rock iguanas, these lizards were common in all the lowland areas of Morelos. Rocky bluffs and cliffs were the preferred habitat of large individuals, especially where crevices and crannies provided den sites. In this respect horizontally stratified sedimentary outcrops and canyon walls were especially well suited and harbored the largest populations. Some large individuals apparently dwell in trees; all are adept at climbing bushes and trees. Although usually slow-moving, they are wary and seek shelter on slight pretext. Apparently they are strictly vegetarian.

The breeding season must be early in the year because from late July on, numerous young, green individuals were seen. Gonads of the adults taken at that time were small and in non-breeding condition.

The dorsal color pattern of adults is exceedingly variable. Most of them are black and white, the black predominating. Some are blackish with large areas of yellowish. The tail is normally brown, banded with whitish.

Phrynosoma orbiculare alticola Davis

Specimens examined: 4-5 km. N Tres Cumbres, 5 males, 3 females; near K57, between Mexico City and Cuernavaca, 1 (EHT-HMS Coll., no. 4591).

One ordinarily associates *Phrynosoma* with desert conditions, but this race lives in the tall grass parks in the pine forest at elevations above 8,000 feet where the weather is cool and damp.

Two males and two females, snout-vent length 63 to 74 mm., were in breeding condition when captured (August 8-20). Testes of the males were 8 to 10 mm. in length, ova in the females 9 mm. in diameter. One female contained 12 enlarged ova, the other 13. Three young males, snout-vent length 48-50 mm., had testes 5 mm. in length; one female, 39 mm. in snout-vent length, had infantile ovaries.

Sceloporus aeneus Wiegmann

Specimens examined: 2 mi. W Huitzilac, 6 females; 4-5 km. N Tres Cumbres, 6 males, 19 females. Additional record (Smith, 1939a): Tres Cumbres.

These small lizards were relatively common in the timbered section. In all, 37 specimens were preserved, 6 from near Zempoala, in the state of Mexico. Of these, three were found on rocks, 6 in tall grass, 2 on living trees, 6 in a brush pile, 4 on down logs, 4 on pine stumps and 2 under loose bark on logs. No habitat data were recorded for the others. This indicates a preference for trees and logs.

Ten of the 28 females, collected from July 25 to August 15, contained from 3 to 5 (average, 4) large ova, the largest measuring 6 x 12 mm.; 12 of the others appeared to have oviposited and in the others the ova were minute, less than 1 mm. in diameter. In none of the large ova was there any recognizable evidence of embryonic development. Snout-vent length of 6 adult males averaged 44.8(40-50) mm.; of 19 adult females, 47.7(43-56) mm.

The fact that these lizards are oviparous rather than ovoviviparous (as is the case with *bicanthalis*) makes it necessary to reconsider the relationships of *aeneus* and *bicanthalis*, both of which are currently recognized (Smith, 1939a) as subspecies of *Sceloporus aeneus*. The occurrence of both types of reproduction in a single species is extraordinary. It is of course possible that both types of reproduction occur in both forms. In such case it is not likely that altitude is correlated because many of these specimens of *aeneus* were taken at an elevation of 10,000 feet, near the maximum for the species. On the other hand, each type of reproduction may be (as seems more likely) strictly and exclusively associated with only one of the populations here under consideration. Known existence of both forms in a single area (Mt. Popocatepetl; Smith, 1939a: 361) adds still further doubt of a subspecific relationship.

In the absence of evidence of intergrading specimens, the information now available clearly indicates the probability that *aeneus* and *bicanthalis* represent different species. *Sceloporus bicanthalis* occupies a range adjacent to that of *S. scalaris*, with which it agrees in some respects but apparently not in manner of production of young, since *S. scalaris* is oviparous. It seems likely that phylogenetically *S. bicanthalis* not only is specifically distinct from all other members of the *scalaris* group, but also occupies a central and primitive position in relation to others of its group. Its dark ventral color may be regarded a forerunner of the condition in *aeneus*, and its barred ventral pattern, as well as two canthals, are features re-

tained by *scalaris*. In view of the common occurrence of ovoviviparity in primitive groups of *Sceloporus*, this feature also of *bicanthalis* may be regarded as indicative of a primitive position within its group.

Sceloporus horridus horridus Wiegmann

Specimens examined: Alpuyeca, 11 males, 7 females, 1 yg.; 6 mi. NW Alpuyeca, 2 males, 4 females; El Rodeo, 13 males, 5 females; Lago Tequesquitengo, 1 male, 1 female; Puente de Ixtla, 1 male, 2 females; 3 km. N Puente de Ixtla, 1 male, 3 females; 6 mi. W Yautepec, 2 females, 1 yg.; 20 km. NE Cuautla, 1 male, 1 female; 13-15 km. NE Cuautla, 2 males, 1 female; 12 km. NW Axochiapan, 25 males, 20 females; 2 km. S Jonacatepec, 22 males, 9 females, one yg. (26 mm. S-V length); Temilpa, 1 female; Tlacotepec, 1 yg. (23 mm. S-V length). Additional records (Smith, 1939a): 2 mi. N Cuernavaca; Cuernavaca; 9 mi. S Cuernavaca; 4 mi. S Cuernavaca; Cuautla; 5 mi. S Puente de Ixtla; Jojutla; Yautepec; Amitcingo; Xochicalco.

This is the most common species of *Sceloporus* in the lowland sections of Morelos. It is outranked in abundance only by the ubiquitous *Cnemidophorus sacki*. It is usually found in association with rocks—rock fences and boulder piles being especially well suited to its needs—but many of them are found in trees. Sexually mature males ranged from 87 to 114 mm. in snout-vent length, females from 75 to 94 mm. All females taken in late July and the first 10 days of August contained from 5 to 16 (average, 10.5) enlarged ova; those captured near the middle of August contained fully developed eggs measuring about 8 x 15 mm., or had recently oviposited. Four newly hatched young, 23 mm., 26 mm., 26 mm. and 32 mm. in snout-vent length were captured August 4 to 16. Other than these four, no specimens less than 75 mm. in snout-vent length were captured and all of them were sexually mature. Seemingly sexual maturity is attained in one year.

Sceloporus jarrovi sugillatus Smith

Specimens examined: 2 mi. W Huitzilac, 18 males, 8 females; 5 km. N Tres Cumbres, one young female.

West of Huitzilac these lizards were restricted to sedimentary rocks along the highway and occupied those areas to the exclusion of *Sceloporus torquatus torquatus*, which were widely distributed on the dark basaltic outcroppings. Sexually active males (testes 3 to 8 mm. in diameter) ranged from 72 to 93 mm. in snout-vent length; females with ova 3 to 8 mm. in diameter measured 63 and 77 mm. in snout-vent length. Five young specimens 39 to 50 mm. were all sexually immature. This species appears to have a lower breeding potential than *S. t. torquatus*. In *sugillatus* the average number of enlarged ova in gravid females was 5; in *torquatus*, 9.

The subspecies has been reported previously only from the type locality (east end of Lake No. 4, Lakes of Zempoala), some 10 kilometers west of Huitzilac. Inasmuch as this lake is within the boundaries of the state of Mexico (the Mexico-Morelos line passes five kilometers to the east of the Lakes area), the present records are the first for the state of Morelos.

The specimens are typical, having dark transverse streaks on the sides of the belly and in females a bluish patch on the sides of the belly much as in males.

Sceloporus grammicus microlepidotus Wiegmann

Specimens examined: 2 mi. W Huitzilac, 19 males, 12 females; 1½

mi. SE Huitzilac, 7 males, 10 females; 3 km. SE Tres Marias, 6 males; 4-5 km. N Tres Cumbres, 17 adult males, 17 adult females and 22 juveniles. Additional records (Smith, 1939a): Tres Marias; 5-6 km. S Tres Marias; 9-14 km. S Tres Marias; Zempoala [probably in state of Mexico]; Cuautla; Cuernavaca.

These lizards were abundant in the vicinity of Tres Cumbres and Huitzilac, preferring open forested areas. Of the 50 specimens for which the site of capture was recorded, 12 were found on rocks, 22 on standing trees, 10 on logs, 5 under logs, and 1 under a rock. These data hardly agree with Smith's (1939) statement that this subspecies is completely arboreal, although an arboreal preference is apparent.

Of the specimens taken the last week in July and the first half of August, four females had an average of 4.5 ova measuring 4 mm. in diameter; in all others the ova were 3 mm. or less in diameter. Females as small as 33 mm. in snout-vent length were approaching sexual maturity. In most males larger than 36 mm. in snout-vent length the testes were from 4 to 8 mm. in diameter. Sexually mature males ranged in snout-vent length from 37 to 73 mm.; females, 33 to 67 mm.

Sceloporus gadoviae Boulenger

Specimens examined: 6 mi. NW Alpuyeca, 2 males; 10 mi. NE Alpuyeca, 3 males, 3 females; ¼ mi. SW Puente de Ixtla, 1 female; 12 km. NW Axochiapan, 11 males, 12 females. Additional record (Smith, 1939a): 5 mi. S Puente de Ixtla.

This wary lizard was found only on rocky cliffs. Adult males taken in late July and early August were sexually inactive; four of the females contained large ova 10 to 15 mm. in length, the others had ova 5 millimeters or less in diameter and probably had already oviposited. One recently hatched juvenile, 24 mm. in snout-vent length, was captured August 7. These data suggest that the peak of active breeding is in June. Adulthood seemingly is reached in the third year of life. Specimens from 36 to 43 mm. in length, with infantile gonads, were presumably one year old. Adult males ranged from 63 to 68 mm. in snout-vent length; adult females, 50 to 55 mm.

Sceloporus ochoterenae Smith

Specimens examined: 6 mi. NW Alpuyeca, 1 male, 1 yg.; 6 mi. W Yautepec, 1 male. Additional records (Smith, 1939a): Cuernavaca; 15 km. S Cuernavaca; 5 mi. S Puente de Ixtla.

This lizard is either rare or difficult to find. One of our adult specimens was captured in grass, the other was clinging to the side of a boulder. In both males, taken August 12 and 17, the testes were about 3 mm. in diameter. These specimens were 46 and 51 mm. in snout-vent length. A recently-hatched specimen 21 mm. in snout-vent length was captured in a grassy habitat on August 12.

Sceloporus torquatus torquatus Wiegmann

Specimens examined: 3 km. NW Tres Cumbres, 3 males, 1 female; 3 km. SE Tres Cumbres, 2 males (immature); 4-5 km. N Tres Cumbres, 6 males (2 adult); 2 mi. W Huitzilac, 17 males (11 adult), 4 females; 1½ mi. S Huitzilac, 1 yg. Additional records (Smith, 1936): near km. 63, on highway between Mexico City and Cuernavaca; 5 km. S Tres Cumbres; near Tres Cumbres.

These large, collared lizards were most abundant on the dark basaltic rocks throughout the forested area near Huitzilac and Tres Cumbres, mainly above an elevation of 7800 feet. We encountered only 6 of the

34 specimens on logs or under the bark of stumps and fallen trees, all of which were juveniles less than 50 mm. in snout-vent length.

Our adult specimens, taken from July 25 to August 12, were in breeding condition. Males ranging from 81 to 102 mm. in snout-vent length had testes 8 to 12 mm. in diameter; females ranging from 71 to 96 mm. contained from 8 to 12 (average 9) ova from 1 to 3 mm. in diameter. Specimens smaller than 71 mm. in snout-vent length were sexually immature. The specimens fall into three distinct size and age classes, the two larger ones sexually mature, which suggests that sexual maturity is attained in one year.

Sceloporus scalaris scalaris Wiegmann

Specimen examined: 2 km. S Jonacatepec, 1 adult male. This specimen was taken in open plains country at an elevation of approximately 4,000 feet. In addition to constituting a new record for the state, the specimen also is from the lowest elevation recorded for the species. Smith (1939a) had no records below 5,000 feet.

Urosaurus bicarinatus bicarinatus (Dumeril)

Specimens examined: Alpuyeca, 1 juvenile; 2 km. S Jonacatepec, 21 males, 11 females; 12 km. NW Axochiapan, 10 males, 7 females. Additional records: Cuernavaca (Günther, 1885-1902; Burt and Myers, 1942); 4 mi. S Cuernavaca (Smith, 1935); Puente de Ixtla (Smith, 1935).

This lizard seems to be most abundant along water courses where trees or tree-like cacti are present. Only 3 of our specimens were found on the ground; the other 47 were collected from trees and arborescent cacti. They are wary, protectively colored, and must be looked for diligently.

Adult males taken in late July and early August had testes 4 or 5 millimeters in length; 15 of the 18 adult females contained from 4 to 8 (ave. 6.4) enlarged ova ranging from 4 to 9 millimeters in length; the others appeared to have oviposited. The young specimen taken at Alpuyeca in mid-August measures 19 mm. in snout-vent length and appears to be newly hatched. Adult males average 53.3 (47-58) mm. in snout-vent length; females, 47.8 (44-51) mm.

Eumeces copei Taylor

Specimens examined: 2 mi. W Huitzilac, 2 males, 2 females; 3 km. NW Tres Cumbres, 2 (yg.); 4-5 km. N Tres Cumbres, 8 adult males, 9 adult females, 3 yg. Additional records (Taylor, 1935): near Tres Marias.

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These skinks were especially abundant north of Tres Cumbres where we captured 20 specimens. Most of them were found in moist situations under rocks or rotten logs, often in association with salamanders. All the males 55 mm. or more in snout-vent length had testes measuring 4 x 7 mm. In all the females the ova ranged from 5 to 8 in number but none was more than 1 mm. in diameter. Five young specimens measured 28 to 35 mm. in snout-vent length and probably were only two or three months of age.

Mabuya mabouya mabouya (Lacepede)

Specimens examined: Alpuyeca, 1 adult male; 6 mi. W Yautepec, 1 male.

This species seemingly is either rare or elusive. The two specimens captured were found in tall grass. The male from Alpuyeca, taken Au-

gust 5, measured 65 mm. in snout-vent length, 175 mm. in total length; the testes appeared to be sexually active. Dorsal scale rows from parietal to above anus, 57; scale rows around middle of body, 28; ratio of axilla-groin length to snout-vent length, 52. The specimen from near Yautepec is 48 mm. in snout-vent length, has 29 scale rows at middle of body, and about 58 rows from parietal to above anus. In both specimens there is a black dorsolateral line about two scales wide from snout to tail bordered below by a distinct white stripe and below this another blackish stripe from mouth to hind leg. The upper light stripe is barely discernible.

The species has not been recorded previously from Morelos, although its occurrence was expected.

Cnemidophorus deppii lineatissimus Cope

Specimens examined: 6 mi. NW Alpuyeca (vicinity of Ruinas de Xochicalco), 8 males, 3 females; Alpuyeca, 1 male; 3 km. NE Puente de Ixtla, 6 males; Temilpa, 7 males, 2 females; 15 mi. E Cuautla, 1 male; 12 km. NW Axochiapan, 4 males, 2 females.

Most of these specimens were found among rocks on hillsides covered with sparse xeric vegetation; one was taken at the side of the highway near a corn field. The two dark lateral stripes in males, the lower vinaceous red, the upper chocolate brown in life, contrast conspicuously with the olivaceous dorsal coloration; underparts in males are dark bluish in the preanal and femoral regions, grading to velvety black on abdomen, the black extending over chest and throat to chin; females are whitish below. Three of the females (July 29 to August 21) contained four ova each, 5 mm. in diameter; one (August 21) contained two large eggs with shell, another taken the same date had two ova 4 mm. in diameter.

The specimens are somewhat intermediate between *C. d. deppii* and *C. d. lineatissimus,* but average nearer the latter. The best character to distinguish these races, other than color, is the lower preocular-loreal contact, and in this respect these specimens are typical *lineatissimus,* for in only 2 (and on one side only of one of these) of 11 specimens is there a separation of the scales on either side. The number of femoral pores in males (15-20, ave. 17.1 in 54 counts) is intermediate but close to the expected average (16.5) for *lineatissimus.* There is, however, an east-west gradient evident in this character. Specimens from Puente de Ixtla (west) average 16.2 (12 counts); those from Temilpa (central), 17.2 (14 counts); those from Axochiapan (east), 18.1 (8 counts). The preanals are more truly intermediate, 6 specimens having 5 rows, 5 having 6; the minimum in typical *lineatissimus* is 6. In coloration the specimens are intermediate, for blue is present on the femora and posterior part of the abdomen in males, while in *deppii* all ventral surfaces are black and in *lineatissimus* only the chest, throat and chin are black. The dorsal coloration, with loss of the central stripes, is typical of *lineatissimus.*

The species has not been recorded previously from Morelos.

Cnemidophorus gigas Davis and Smith

Specimens examined: Alpuyeca, 9 males, 2 females; Laguna Rodeo, 4 males, 1 female; Puente de Ixtla, 3 females; 6 mi. W Yautepec, 2 males, 4 females; 12 km. NW Axochiapan, 12 males, 4 females; Temilpa, 1 male, 3 females.

This species was common in the lowland scrub desert area, especially in rocky situations covered with weeds, scattered prickly pear, and thorny shrubs. Only one specimen was taken on sandy soil and one in an open grassy area. Only one of 17 females taken (late July) was gravid. The testes in all males were small. Snout-vent length in males varied from

100 mm. to 150 mm.; in females, 90-124.

Cnemidophorus sacki sacki Wiegmann

Specimens examined: Alpuyeca, 41 males, 8 females; 7 mi. W Alpuyeca, 2 females; 7 mi. NE Alpuyeca, 1 male; 6 mi. NW Alpuyeca, 2 females; Puente de Ixtla, 3 males, 1 female; 3 km. NE Puente de Ixtla, 16 males, 7 females; Temilpa, 10 males, 5 females; 2 km. S Jonacatepec, 27 males, 5 females; 10-20 km. NE Cuautla, 2 males, 6 females; El Rodeo, 14 males, 6 females; 6 mi. W Yautepec, 10 males, 6 females; 12 km. NW Axochiapan, 21 males, 7 females; Tepoztlan, 1 male, 4 females; Tlacotepec, 1 male.

Sexually mature males range in size from 70 mm. to 112 mm. in snout-vent length; females, from 71 mm. to 92 mm. Nine of the females seemingly had recently oviposited; females less than 70 mm. in snout-vent length were sexually immature.

These lizards were abundant in the lowland region, inhabiting chiefly rocky areas covered with scattered chaparral; also they occurred in numbers in open grassy areas.

These specimens differ conspicuously from typical *gularis* from Texas in the absence in adults of a well-defined light tail stripe (continuation of second lateral stripe) and in the presence in old individuals of distinct spots on the upper surfaces of the hind legs and across the base of the tail. In large males (presumably older ones) the longitudinal stripes tend to become obliterated and transverse "tiger" stripes become prominent. Two of the females are dark ventrally, a color usually confined to males.

In using the name *sacki* we have followed Smith (1949b).

Barisia imbricata imbricata (Wiegmann)

Specimens examined: 2 mi. W Huitzilac, 1 male, 4 females; 4-5 km. N Tres Cumbres, 9 adult males, 7 adult females, 3 juveniles. Additional records (Tihen, 1949): Cuernavaca; Tepoztlan; near Tres Marias.

This species is rather common in the tall grass (sacatón) section of the mountains in northern Morelos. In addition to the 20 specimens from near Tres Cumbres and Huitzilac, we captured 13 others at Lagunas de Zempoala, Mexico, all of them in the last week of July and the first two weeks of August. Of those on which the site of capture was recorded, 22 were found in clumps of sacatón, 2 were on trails, 3 were under logs, and one was inside a rotten log.

Adult females ranged in snout-vent length from 82 to 118 mm.; males from 81 to 119 mm. Nine of the females contained from 5 to 11 enlarged ova (6 to 8 mm. in diameter); in all others they were only slightly enlarged. The testes in all males were relatively small (4 x 2 mm.), suggesting that the breeding season was nearly at an end.

Those specimens (TAM 919-920) listed by Tihen (*op. cit.*) under the heading *Mexico* or *Morelos* were actually from near Lagunas de Zempoala, in the state of Mexico. These specimens were taken by one of Davis' students in 1942 who collected in the immediate vicinity of the lake at the end of the road some five kilometers (by road) west of the Mexico-Morelos boundary which crosses the highway at Kilometer 10. Since the National Park of Las Lagunas de Zempoala lies in both Mexico and Morelos, some confusion has resulted in locality records bearing the name Zempoala. The lakes, however, are entirely in the state of Mexico.

Kinosternon integrum Le Conte

Specimen examined: Zacatepec, 1 adult male.

Mud turtles appear to be restricted to the rice and sugar cane growing sections of Morelos. This specimen was captured in a roadside pool into which water from cane fields drained. Several others were seen but not preserved.

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Death of an Ornate Box Turtle Parasitized by Dipterous Larvae

By DENNIS G. RAINEY

An ornate box turtle, *Terrapene ornata* (Agassiz), discovered near Lawrence, Kansas, was found to be heavily infested with larvae of a flesh fly, identified by Dr. Willis W. Wirth of the U. S. National Museum as *Sarcophaga cistudinis* Aldrich. This find is especially noteworthy in view of the paucity of published records. Peters (1948) reviews the literature concerning this flesh fly and, in addition, reports the parasitic larvae in two specimens of *Terrapene carolina* (Linnaeus). He found 19 in one and 24 in the second. Rokosky (1948) also found the larvae in *Terrapene carolina,* 23 in one and four in a second. McMullen (1940) reports collecting 25 larvae from an ornate box turtle which he obtained near Oklahoma City, Oklahoma. He states that this "is the second record of the fly in the Southwest." Rodeck (1949) obtained a single specimen of the ornate box turtle on the Cimarron River in northwestern Oklahoma and found that it harbored 15 larvae. All of them were in one cyst.

The present report furnishes an additional record of the occurrence of *Sarcophaga cistudinis* larvae in the ornate box turtle. This flesh fly has not previously been recorded from turtles in Kansas so far as I am able to determine. Hall (1929) records the adult fly from McPherson and Chautauqua counties, but cites no instance of the larvae being found in turtles. It is noteworthy that the two flies listed by him compose the entire collection of adults from Kansas that is now in the Snow Entomological Collection of the University of Kansas.

On August 15, 1952, while I was walking through a wooded area 5 miles north, 1¼ miles east of Lawrence, Douglas County, Kansas, two crows were flushed from the bank of a small dry creek. Investigation revealed that an ornate box turtle was the object of the crows' attention. It was carried to the laboratory of the University of Kansas Natural History Reservation for routine weighing, marking, and examining. The carapace measured 72.2 mm. in length and 64.7 mm. in width. A small hole in the skin of the right front leg was at first thought to be a wound resulting from pecking by the crows, but closer examination with a hand lens revealed the presence of subcutaneous larvae. Three of them could be seen protruding slightly from the orifice. When they were touched with a needle they reacted by temporarily withdrawing. While being handled the turtle exhibited a pronounced reluctance to withdraw the limbs into the shell. The turtle was placed in a container and the following morning was found dead not perceptibly shifted from the position in which I had left it the evening before.

Two lesions were found on the right front leg, one on the elbow and the other in the axilla; the latter had almost penetrated the body cavity. Four larvae were removed from each of these lesions. Five larvae were taken from the left hind leg and a single specimen from under the neck in the loose skin that attaches to the plastron. A total of 14 larvae were removed.

Considering the large amount of space occupied by the larvae and the position in which they occurred in the legs, normal locomotion certainly would have been impeded if not prevented. The digestive tract was dissected and found to be empty. This suggests that the turtle was not

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able to secure sufficient food because of the hindrance to its movements. No other probable cause of its death was found.

Eight larvae are now on permanent deposit in the entomological collection at the University of Kansas Natural History Reservation and the remainder are deposited in the U. S. National Museum.

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Notes on the Taxonomy and Distribution of the Lizard Species *Uta ornata* and *Uta graciosa*

By KEITH MURRAY

An examination of specimens of *Uta ornata* and *graciosa* in the Museum of Vertebrate Zoology has provided several items of distributional and taxonomic interest, which are reported here.

Uta ornata wrighti in Wyoming

A specimen in the Museum of Vertebrate Zoology (no. 32160) appears to be the first record of this species from Wyoming. It was obtained one mile north of Green River City, 6400 feet, Sweetwater County, about 75 miles north-northeast of Vernal, Uinta County, Utah, the nearest locality recorded by Mittleman (1942). It is a male with a pale blue throat and blue ventral patches that meet posteriorly. There is a single irregular vertebral row of small scales. The enlarged dorsals are in two rows on each side, with a third row slightly enlarged.

The Status of *Uta ornata chiricahuae*

The race *chiricahuae* was described by Mittleman (1941) from 37 specimens from the Chiricahua and Dos Cabezos mountains, Cochise County, Arizona. This entire series, with several additional individuals, has been examined and compared with 62 specimens of the surrounding race *linearis* from Arizona and New Mexico. The peculiarity of a subspecies within the range of another, in an area not notable for its endemism, and in a highly variable species, prompted re-examination of the evidence.

The enlarged dorsal scales were described as smaller than the enlarged

femoral and tibial scales in *linearis,* while equal to the femoral and larger than the tibials in *chiricahuae.* I have been unable to detect such differences and doubt that it is possible to express them meaningfully in these terms. Consequently, counts were made of the number of enlarged dorsals between axilla and groin, with the assumption that the size of the scales is directly reflected. For *chiricahuae* the mean number is 29.6±.39 (25-37); for 15 specimens from the nearby Huachuca Mountains, Cochise County, Arizona the mean is 28.9±.75 (24-36); for 17 specimens from Santa Cruz County, Arizona it is 29.8±.71 (26-36); for nine specimens from southwestern New Mexico it is 31.6. Numerous other scattered records outside the range of *chiricahuae* were closely comparable. No difference for *chiricahuae* is indicated.

Mittleman states, "The vertebral series of enlarged scales in *linearis* does not extend onto the basal portion of the tail for a distance equal to much more than one quarter the length of the femur; in *chiricahuae,* the distance is equal to at least half the length of the femur, often more." Again, comparison did not bear out the difference, and determination of the characteristic is frought with subjectivity. As a measurable alternative, the number of enlarged dorsal scales was counted from the posterior insertion of the femur to the posterior extent of the vertebral scales onto the tail. In nine, or 25.7 per cent of the *chiricahuae* specimens the vertebrals did not even extend past the posterior surface of the femur. The maximum extent onto the tail was five scales, averaging 3.1 scales. In specimens from the Huachuca Mountains, the vertebrals of one (6.7 per cent) did not extend past the femur. The maximum extent was six scales and the average was 3.4 scales. In the series from Santa Cruz County, vertebrals of one did not extend past the femur, the maximum extent was five scales, the average 2.3. It is apparent that no appreciable difference is present. The variation in the character is so great that it is of doubtful taxonomic value.

The mean ratio of head width/head length was given as higher for *chiricahuae* than in surrounding representatives of the species. The ratios which I obtained were: *chiricahuae* .721±.004 (.667-.773), Huachuca Mountains .700±.006 (.652-.741), Santa Cruz County .692±.008 (.641-.782), southwest New Mexico .714 (.684-.749). The degree of difference for *chiricahuae* is considerably less than that described by Mittleman. It remains significant, but no greater than differences between populations of *linearis.*

Finally, Mittleman states, "The uniform blue color of the gular region in *chiricahuae* is very rare in *linearis,* and is usually replaced by a medial blotch of yellow or orange; similarly, the relative uniformity of color in the interhumeral and interfemoral regions in *chiricahuae* is in the great majority of *linearis,* replaced by a heavy stippling or mottling of dark gray or brown."

I found every degree of stippling and mottling of the underparts in both *chiricahuae* and *linearis,* with no detectable difference in frequency or amount. The color of the gular region is known to differ widely throughout the species, ranging from yellow or orange through green to bright blue. The yellow and orange color generally disappears in preservative. Where there was green, a pale blue remains. Since the entire series of *chiricahuae* was preserved, there is little basis for setting up such a differential character. There is, in fact, a number of males of that series with pale blue gulars, suggesting that yellow pigment had been present.

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Of the differences originally used to characterize the race *chiricahuae*, only the ratio of head width/head length appears to stand up under close scrutiny, and this ratio differs as widely between samples of *linearis*. It is my opinion that *chiricahuae* should be placed in the synonomy of *linearis*.

The Status of *Uta ornata levis*

The subspecies *levis* and *wrighti* were synonomized by Van Denburgh (1922). Mittleman (1942) has resurrected *levis*, based on ten adults from Rio Arriba and northern Sandoval counties, New Mexico, as distinct from *wrighti* which ranges through much of Utah, New Mexico, and Arizona. The Museum of Vertebrate Zoology has two adults which evidently were not examined by Mittleman, from one mile southwest of Coyote, 6900 feet, Rio Arriba County, New Mexico.

The differential features listed for *levis* were flatness and weakness of keeling of the enlarged dorsals; slight development or absence of cervical, dorsolateral and lateral tubercles, and lateral folds; gradual merging of dorsal basal scales of the tail with the lateral ones.

Comparing them with representatives of *wrighti*, I am unable to find differences in these characters, except that there is less keeling of the enlarged dorsals than in most *wrighti*. However, the keeling of the latter varies greatly, and in a number of specimens is scarcely visible. Consequently, it appears that this race should be regarded as questionable until its validity is demonstrated with a larger series, particularly since the differences listed are slight and the variation in the species is great.

Range Extension of *Uta graciosa*

A male, MVZ 20530, was collected by Dr. A. H. Miller eight miles south of Coolidge, Pinal County, Arizona. This locality extends the recorded range of the species about 150 miles to the east. The habitat, described in Dr. Miller's field notes, was open mesquite with *Atriplex* and a few chollas.

Four specimens were obtained by Dr. R. C. Stebbins from an intermediate location 6.9 miles west-southwest of Gila Bend, Maricopa County, Arizona. All were in mesquite trees, in a region of level desert with short creosote bushes.

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